SOIL SURVEY OF

Highland County, Ohio

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Ohio Department of Natural Resources
Division of Lands and Soil and
Ohio Agricultural Research and
Development Center

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in the period 1963–69. Soil names and descriptions were approved in 1973. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1973. This survey was made cooperatively by the Soil Conservation Service and the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center. It is part of the technical assistance furnished to the Highland County Soil and Water Conservation District.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Highland County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification and woodland group of each. It also shows the page where each soil is described and the page for the capability unit in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units.

Foresters and others can refer to the section "Use of the Soils for Woodland," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings and for recreation areas in the section "Soils and Land Use Planning for Town and Country Development."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section, "Formation and Classification of the Soils."

Newcomers in Highland County may be especially interested in the section, "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given at the beginning of the publication and in the section "General Nature of the County."

Cover: **Pasture on gently sloping Celina soils. This area is typical of those in the county where Wisconsin glaciation took place.**

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SOIL SURVEY OF HIGHLAND COUNTY, OHIO

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United States Department of Agriculture, Soil Conservation Service, in Cooperation With Ohio Department of Natural Resources, Division of Lands and Soil, and Ohio Agricultural Research and Development Center

HIGHLAND COUNTY is in the southwestern part of Ohio (fig. 1). It has a total land area of 549 square miles, or 351,360 acres. The population in 1970 was 28,996. Hillsboro and Greenfield are the largest towns in the county. Hillsboro, which is near the center of the county and the county seat, had a population of 5,584 in 1970. Greenfield, which is in the northeast part of the county, had a population of 4,780. There are a number of small towns and villages.

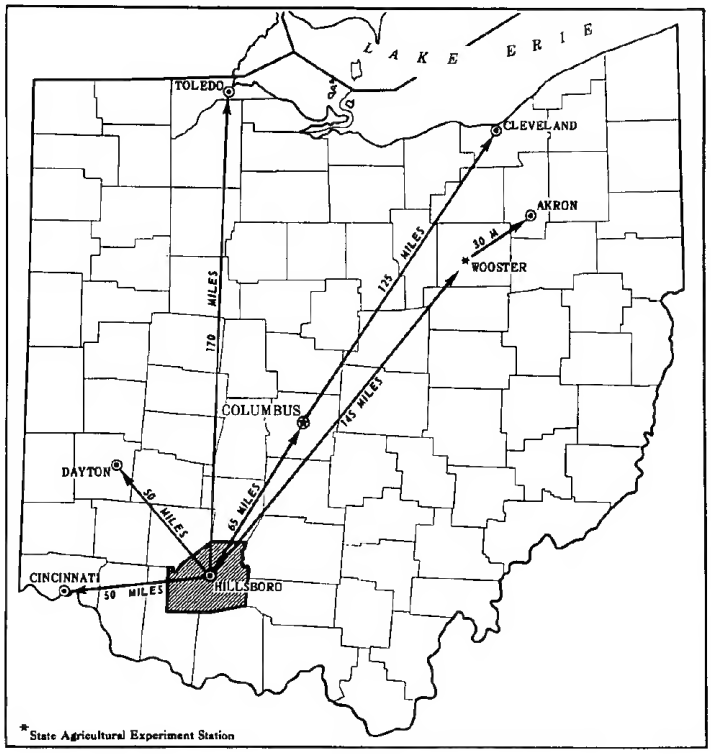

Figure 1.—Location of Highland County in Ohio.

Farming is the leading occupation. According to the 1969 Census of Agriculture, a large part of the farm income came from the sale of livestock and livestock products, mainly swine, beef cattle, and dairy products. Corn, soybeans, wheat, hay, and tobacco are the principal crops. The 1967 conservation needs inventory of Highland County (*9*)[2] shows 66.5 percent of the acreage in crops, 25 percent in forest, and 6.5 percent in pasture.

The topography of Highland County ranges from nearly level on the glacial till plains in the western and northern parts of the county to steep and hilly in the unglaciated southern part. Wetness is the main soil limitation in the more nearly level areas, but controlling erosion is a main concern in farming the more sloping areas.

Recreation is a growing land use, because this county is partly near the metropolitan areas of Dayton and Cincinnati. Rocky Fork Lake, east of Hillsboro, is an important recreational center. Paint Creek Reservoir, after it has been constructed at the eastern edge of the county, is likely to be another large recreational attraction.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Highland County, where they are located, and how they can be used. The soil scientists went into the county knowing they were likely to find many soils they had already seen and perhaps, some they had not. They observed the steepness, length, and shape of slopes; the size and speed of streams; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied. They compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or

[1] Others assisting with fieldwork were JAMES H. PETRO, GARY L. SEITZ, and ARTHUR G. HOCK, Ohio Department of Natural Resources, Division of Lands and Soil, and MARION F. TABB, HORACE SMITH, and W. LESLIE BARNHILL, United States Department of Agriculture, Soil Conservation Service.

[2] Italic numbers in parentheses refer to Literature Cited, page 202.

other geographic feature near the place where a soil of that series was first observed and mapped. Avonburg and Clermont, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer, slope, stoniness, or some other characteristics that affect use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Avonburg silt loam, 2 to 6 percent slopes, is one of several phases within the Avonburg series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. One such kind of mapping unit is shown on the soil map of Highland County: soil complex.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Boston-Bratton complex, 6 to 12 percent slopes, moderately eroded, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Urban land is an example.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yield of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or its high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Highland County. A soil association is a landscape that has a distinctive pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or other structure because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in this survey have been grouped into four general kinds of landscapes for broad interpretative purposes. Each of the broad groups and their included soil associations are described in the following pages.

Soils That Formed Mainly in Wisconsin-Age Glacial Till

These nearly level to very steep soils are on the Wisconsin-Age glacial till plains in the northern part of the county. They are very poorly to well drained. If farmed, most of these soils have a high to moderate productivity potential. Most of the farms in the association are general, cash grain, or dairy farms. The four associations in this group make up about 25 percent of the county.

1. Miamian-Celina-Brookston association

Deep, nearly level to steep, well drained, moderately well drained, and very poorly drained soils that formed in thin loess and the underlying glacial till

The soils of this association are in the northeastern part of Highland County.

This association makes up about 4 percent of the county. It is about 50 percent Miamian soils, 10 percent Celina

soils, 10 percent Brookston soils, and 30 percent minor soils.

The dominant Miamian soils are light colored, well drained, and gently sloping to steep. Celina soils are light colored, moderately well drained, and nearly level to gently sloping. Brookston soils are dark colored, very poorly drained, and nearly level to depressional.

The minor soils in this association are light-colored, somewhat poorly drained Crosby soils and moderately well drained Cana soils. The Cana soils are underlain by acid shale bedrock at a depth of 2 to 5 feet. Other small areas of minor soils are Kendallville and Dana soils on the uplands and small areas of Eel and other soils that form in alluvium on the flood plains.

The control of erosion is the main management concern on Miamian soils and the gently sloping Celina soils. Artificial drainage is needed only in scattered wet spots. Soil wetness is the main management concern on Brookston and Crosby soils. A seasonal high water table and ponding normally occur early in spring, and tile is commonly used to remove this excess water so that the soil can be tilled earlier. If improved management is used, this soil association has a moderately high to very high productivity potential. Most of the farms are general and cash grain farms.

Moderately slow permeability and a seasonal high water table are limitations for many nonfarm purposes.

2. *Brookston-Crosby-Fincastle association*

Deep, nearly level to gently sloping, very poorly drained and somewhat poorly drained soils that formed in thin loess and the underlying glacial till

The soils of this association are nearly level to gently sloping in the northern part of the county.

The association makes up about 2 percent of the county. It is about 70 percent Brookston soils, 10 percent Crosby soils, 5 percent Fincastle soils, and 15 percent minor soils.

Brookston soils are dark colored, very poorly drained, and nearly level to depressional. Crosby and Fincastle soils are light colored, somewhat poorly drained, and nearly level to gently sloping.

The minor soils in this association are the Celina, Miamian, and Xenia soils on uplands and the Algiers soils on flood plains.

Soil wetness is the major management concern. A seasonal high water table and the ponding of water in depressions sometimes delay spring tillage. Where suitable outlets are available, tile drainage is commonly used to remove the excess water. This soil association has a moderately high to very high productivity potential if improved soil-fertility and management practices are used. Most of the farms in this association are general and cash grain farms.

A seasonal high water table and slow permeability or moderately slow permeability of the major soils are limitations for many nonfarm uses.

3. *Miamian-Russell-Celina association*

Deep, gently sloping to steep, well drained and moderately well drained soils that formed in thin loess and the underlying glacial till

This association is in the northern part of the county. Nearly all the soils are light-colored and are mainly gently sloping to steep.

This association makes up about 16 percent of the county. It is about 45 percent Miamian soils, 12 percent Russell soils, 10 percent Celina soils, and 33 percent minor soils.

The dominant well-drained Miamian and Russell soils are gently sloping to steep. Celina soils are moderately well drained and nearly level to gently sloping.

Among the minor soils in this association are Xenia, Crosby, Fincastle, Brookston, and Kendallville soils. Xenia soils are moderately well drained; Crosby and Fincastle soils are somewhat poorly drained and nearly level to gently sloping; Brookston soils are dark colored and very poorly drained and generally are in depressions; and Kendallville soils are well drained and occur in hummocky areas. Other minor soils in this association are Milton and Dana soils on uplands.

Controlling erosion is the main concern in managing the dominant soils. Soil wetness is the main concern in managing most of the minor soils. The potential productivity of the soils in this association is mostly moderately high. The soils are well suited to all crops adapted to the county if improved management practices are used. Among these practices are erosion control and artificial drainage, where needed. Most of the farms in this association are general and cash grain farms.

Moderate permeability to moderately slow permeability and some seasonal wetness of the major soils are limitations for some nonfarm uses.

4. *Hennepin-Milton-Miamian association*

Deep and moderately deep, gently sloping to very steep, well-drained soils that formed in thin silty deposits and the underlying glacial till

The soils of this association are mostly sloping to very steep and are on side slopes of stream valleys. They are light colored and well drained. The association is mainly in Fairfield, Madison, and Paint Townships in the northeastern part of Highland County. Two small areas, which consist mostly of gently sloping to sloping Milton soils, are in Liberty and Penn Townships north of Hillsboro.

This association makes up about 3 percent of the county. It is about 35 percent Hennepin soils, 25 percent Milton soils, 15 percent Miamian soils, and 25 percent minor soils.

Hennepin and Miamian soils are underlain by calcareous glacial till. Depth to the calcareous till ranges from 0 to 18 inches in Hennepin soils and from 18 to 42 inches in Miamian soils. Milton soils are underlain by limestone bedrock at a depth of 20 to 42 inches.

The minor soils in this association are Opequon soils, which are underlain by limestone bedrock at a depth of less than 20 inches, and moderately well drained or well drained Celina, Casco, and Ockley soils on uplands or terraces. Some small areas of soils, including Eel or Shoals soils, on the flood plains are also in this association.

Controlling erosion is the major concern in managing the soils in this association. Steep slopes, stoniness, shallowness to bedrock, and the hazard of erosion are serious limitations in using the soils for cultivated crops. Most of the association is wooded or is in permanent pasture, but the gently sloping to sloping Milton soils are commonly used for cultivated crops. This association has a moderate to moderately low productivity potential. Most of the farms are dairy or general farms.

The heavily wooded areas have potential for recreation use, such as hiking, camping, and nature trails. Steepness and shallowness to bedrock are limitations for many nonfarm uses.

Soils That Formed Mainly in Illinoian-Age Glacial Till

These are nearly level to steep soils that formed in Illinoian-age glacial till on plains in the southern part of Highland County. They are very poorly to well drained. If farmed, these soils mostly have a moderate productivity potential. Most of the soils in this association are used for cash grain, general, and dairy farms. The three associations in this group make up about 49 percent of the county.

5. *Avonburg-Clermont-Blanchester association*

Deep, nearly level to gently sloping, somewhat poorly drained and poorly drained soils that formed in loess and the underlying glacial till

This association is in the western and southwestern parts of the county. These parts of the county are commonly called the "Crawfish Flats." The soils are slightly depressional to gently sloping and are on uplands.

This association makes up about 18 percent of the county. It is about 45 percent Avonburg soils, 35 percent Clermont soils, 5 percent Blanchester soils, and 15 percent minor soils.

The dominant Avonburg soils are light colored, somewhat poorly drained, and nearly level to gently sloping. These soils have a compact, brittle fragipan in the upper part of the subsoil. Clermont soils are light colored, poorly drained, and nearly level. These soils have grayer colors in the subsoil then Avonburg soils. The Blanchester soils are dark colored, poorly drained, and nearly level to slightly depressional.

Among minor soils in this association are very poorly drained, dark-colored Patton and Montgomery soils and the moderately well drained Rossmoyne soils. Among the other minor soils are Atlas, Algiers, and Shoals soils.

Poor soil drainage and ponding of water for extended periods are the major management concerns. A system of combined tile, surface drains, and bedding provides artificial drainage where adequate outlets can be found. Clayey subsoil, which is slowly permeable, extends to a depth of several feet in Avonburg, Clermont, and Blanchester soils. The soils in this association have moderately low to high productivity potential if they are artificially drained and well managed. Most of the farms in this association are general and cash-grain farms.

Wetness and slow permeability or very slow permeability of the major soils are limitations for many nonfarm uses.

6. *Rossmoyne-Hickory association*

Deep, nearly level to steep, moderately well drained and well drained soils that formed in loess and the underlying glacial till

The soils of this association are mainly in the western and southwestern parts of the county, but some are scattered in smaller areas throughout the south-central and eastern parts. These soils are on uplands and are underlain by calcareous glacial till. They are mostly gently sloping to steep.

This association makes up about 14 percent of the county. It is about 60 percent Rossmoyne soils, 20 percent Hickory soils, and 20 percent minor soils.

Rossmoyne soils are light colored, moderately well drained, and nearly level to sloping. These soils have a compact, brittle fragipan in the upper part of the subsoil and are clayey in the lower part of the subsoil extending to a depth of several feet. The Hickory soils are sloping to steep and are underlain by calcareous glacial till at depths of 18 to 45 inches.

The minor soils in this association are Cincinnati, Avonburg, Atlas, Boston, Grayford, Bratton, and Edenton soils on uplands; Fitchville and Sardinia soils on terraces; and Eel and other soils that formed in alluvium on flood plains.

Controlling erosion is the main concern in managing the soils in this association. Scattered wet spots in Rossmoyne soils may require artificial drainage. This soil association has a moderate productivity potential if erosion control and improved soil-fertility and management practices are used. Many of the Rossmoyne soils, except those that are strongly sloping, are used for cultivated crops. The Hickory soils are used mostly for permanent pasture or woodland. The farms in this association are mainly general and dairy farms.

Steepness and moderate permeability to slow permeability of the major soils are limitations for many nonfarm uses.

7. *Boston-Rossmoyne-Bratton association*

Deep and moderately deep, nearly level to moderately steep, well drained and moderately well drained soils that formed in loess and the underlying glacial till

This association is mostly in the central and south-central parts of Highland County. The soils are mainly gently sloping to sloping, but they range from nearly level to moderately steep.

This association makes up about 17 percent of the county. It is about 30 percent Boston soils, 25 percent Rossmoyne soils, 10 percent Bratton soils, and 35 percent minor soils.

These light-colored soils formed in silty deposits, glacial till, and clayey limestone residuum underlain by limestone bedrock. The thickness of the silty deposits, glacial till, clayey residuum, and depth to bedrock are highly variable within short distances.

The Boston and Bratton soils are well drained and sloping to moderately steep. Bratton soils lack a compact, brittle fragipan, and they have a thinner glacial till layer than Boston soils. The depth to limestone bedrock in Bratton soils ranges from 2 to 4 feet. Rossmoyne soils are moderately well drained and are nearly level to sloping. They have a fragipan in the upper part of the subsoil and glacial till or residuum weathered from limestone in the lower part of the subsoil and in the underlying material.

Among the minor soils in this association are Edenton, Opequon, Cincinnati, and Hickory soils. Other minor soils are Haubstadt, Otwell, Dubois, Lawshe, Loudon, Eel, and Shoals soils.

Controlling erosion is the major concern in managing this association. Shallowness to bedrock, a clayey subsoil that has poor stability and compaction characteristics, and steepness are concerns if excavation and construction

take place and are limitations to the use of these soils for some other purposes. These soils have a moderate productivity potential if erosion control and improved soil-fertility and management practices are used. A considerable part of the nearly level to sloping acreage is used for tobacco and other cultivated crops. Many of the steeper Boston and Bratton soils and the minor soils are used for pasture or woodland, or they are not managed. Most of the farms in the association are general and dairy farms. Some widely scattered, isolated areas have a potential value for hiking, camping, nature trails, and other recreational activities.

Steepness, shallowness to bedrock in some areas, and moderately slow permeability to slow permeability are limitations for some nonfarm uses.

Soils That Formed Mainly in Residuum from Limestone, Sandstone, and Shale

These gently sloping to very steep soils are on unglaciated uplands in the southeastern part of Highland County. These are mostly moderately well drained or well drained. These soils mostly have a low productivity potential. They are mainly used for dairy and beef cattle. The three soil associations in this group make up about 10 percent of Highland County.

8. Bratton-Nicholson-Opequon association

Moderately deep, deep, and shallow, gently sloping to very steep, well drained and moderately well drained soils that formed in loess and the underlying residuum from limestone

The soils of this association are gently sloping to very steep and are in an unglaciated area. They are in the townships of Brush Creek and Jackson in the extreme southeastern part of the county.

This association makes up about 2 percent of the county. This association is about 50 percent Bratton soils, 20 percent Nicholson soils, 20 percent Opequon soils, and 10 percent minor soils.

The well-drained Bratton soils have a clayey subsoil and are underlain at a depth of 20 to 40 inches by limestone bedrock. The Opequon soils are similar to Bratton soils, but the depth to limestone is 10 to 20 inches and little or no silty material covers the clayey subsoil. Nicholson soils are moderately well drained and have a compact, brittle fragipan in the upper part of the subsoil. The depth to bedrock is from 3½ to 7½ feet.

Among the minor soils are the dark-colored, well-drained Gasconade soils. These soils are underlain at a depth of 10 to 20 inches by limestone bedrock. Other minor soils are Colyer, Trappist, and Berks soils.

Controlling erosion is the major concern in managing the soils of this association. Sloping to moderately steep Bratton and Opequon soils are highly erodible if they are cultivated. These soils have a low to moderately low productivity potential. Most of the farms in the association are general and dairy farms. Much of this association is used for meadow or pasture, but a smaller part is used for woodland. Tobacco is a special crop of major importance that is grown in cultivated areas of the association.

Shallowness to bedrock, slope, and moderately slow or slow permeability of the major soils are limitations for many nonfarm uses.

9. Colyer-Trappist-Berks association

Shallow and moderately deep, gently sloping to very steep, well-drained soils that formed in residuum weathered from shale and sandstone

The soils of this association are in an extensive unglaciated area of hills in the eastern part of Brush Creek and Paint Townships adjacent to the county line. These soils are mostly sloping to very steep.

This association makes up about 3 percent of the county. It is about 25 percent Colyer soils, 20 percent Trappist soils, 10 percent Berks soils, and 45 percent minor soils.

Colyer soils are underlain at a depth of 10 to 20 inches and Trappist soils, at a depth of 20 to 40 inches by acid shale bedrock. These soils are mainly sloping to steep. The Berks soils are mostly moderately steep to very steep and are underlain by sandstone bedrock at a depth of less than 3 feet.

Among the minor soils in this association are Muskingum and Neotoma soils, which are intermixed with Berks soils, and Wellston, Johnsburg, Tuscarawas, Trappist, and Muse soils. These soils are gently sloping to sloping and are mainly on ridgetops.

Controlling erosion is the major concern in managing the soils of this association, particularly steep soils that have been cleared. Colyer and Trappist soils are very acid and droughty. They are low in potential productivity and not suited to cultivated crops. The Berks soils are very acid and stony. They are low in potential productivity and not suited to cultivated crops. Most of the gently sloping to sloping areas and the ridgetops in the association are used for cultivated crops and pasture. Many of the steeper soils are reverting to woodland. In the heavily wooded areas some logging and pulpwood cutting are done. The major agricultural enterprises in this association are general and dairy farms, but some fruit is produced, particularly in the steeper areas. Most of the soils are used increasingly for pasture and woodland. The association has a potential for horseback riding, hiking, camping, nature trails, and other recreational activities.

Shallowness to bedrock, slope, and moderate to slow permeability of the major soils are limitations for many nonfarm uses.

10. Opequon-Loudon-Lawshe association

Shallow, deep, and moderately deep, gently sloping to very steep, well drained and moderately well drained soils that formed in residuum from limestone and shale

The soils of this association are mainly in Washington, Jackson, and western Brush Creek Townships in the south-central and southeastern parts of the county. The soils are gently sloping to very steep.

The association makes up about 5 percent of the county. It is about 35 percent Opequon soils, 30 percent Loudon soils, 8 percent Lawshe soils, and 27 percent minor soils.

The Opequon soils are light colored, well drained, and strongly sloping to very steep. They are in higher areas than the Loudon and Lawshe soils. The Opequon soils have a stony surface layer and a red clayey subsoil. Limestone bedrock is at a depth of 10 to 20 inches, and there are rock outcrops in some areas.

Loudon soils are light colored, moderately well drained, and gently sloping to steep. The depth to dense, compact shale bedrock is more than 4 feet.

The dark-colored, moderately well drained Lawshe soils are gently sloping to moderately steep areas. Dense, compact shale bedrock is generally at a depth of 2½ to 5 feet.

Among the minor soils in this association are Gasconade, Jessup, Guernsey, Beasley, Grayford, Bratton, and Boston soils.

A serious erosion hazard is the main concern of managing the soils of this association. Severe limitations to the use of these soils for many purposes and a concern if excavation and construction are planned are shallowness to bedrock; a clayey, unstable subsoil; and steepness. Soil slumping and soil creep are common occurrences on this association. Opequon soils have a low productivity potential and generally are not cultivated. A few areas of these soils have been cleared and used for pasture. The Loudon and Lawshe soils have a moderate productivity potential, and gently to moderately sloping areas of these soils are used for row crops, pasture, and some tobacco. Moderate to severe erosion in many places is the result of excessive cultivation some years ago. Dairying and beef cattle are the main kinds of farming, but some are used for pasture or woodland, or they are not managed.

This association has potential value for hiking, horseback riding, camping, nature trails, and other recreational activities. Slope, shallowness to bedrock, and moderate permeability to very slow permeability of the major soils are limitations for many nonfarm uses.

Soils That Formed Mainly in Stratified, Water-Deposited Material

These nearly level to steep soils are on terraces and flood plains throughout the county. They range from somewhat poorly drained to well drained. These soils are commonly used for general or cash grain farming. They have a moderate to high productivity potential. The three soil associations in this group make up about 16 percent of Highland County.

11. Haubstadt-Otwell-Negley association

Deep, gently sloping to steep, moderately well drained and well drained soils that formed in loess and the underlying stratified, water-deoposited material

The soils of this association are mainly gently sloping to moderately steep and are along major stream valleys in the central and eastern parts of Highland County. The most extensive area is along Rocky Fork Creek. Areas of hummocky, sloping to steep soils southwest of Hillsboro and east of Rocky Fork Lake, from U.S. Highway 50 south to Carmel, also are extensive.

This association makes up about 11 percent of the county. It is about 40 percent Haubstadt soils, 20 percent Otwell soils, 20 percent Negley soils, and 20 percent minor soils.

The light-colored, moderately well drained Haubstadt and Otwell soils formed in silty deposits overlying stratified outwash. The outwash is generally underlain by gravel, but in many areas, such as on headwater terraces, it is underlain by glacial till at a depth of 8 to 12 feet. Haubstadt and Otwell soils have a compact, brittle fragipan in the subsoil that impedes percolation of water. The light-colored, well-drained Negley soils are underlain by sand and gravel.

Somewhat poorly drained Dubois soils and poorly drained Peoga soils are minor soils that are nearly level to depressional. Other minor soils in this association are Fox, Grayford, Rossmoyne, and Cincinnati soils on uplands and Shoals, Sloan, and other alluvial soils on flood plains.

The hazard of erosion is the main management concern for the major soils in this association if they are cultivated. Seasonal wetness is a limitation of the minor soils and the less sloping Haubstadt soils. If soil fertility is improved and erosion is controlled, Haubstadt and Otwell soils have a moderate productivity potential. Negley soils have a moderately low productivity potential.

Most of the farms in this association are general, cash grain, or dairy farms. Tobacco is a special crop. A large acreage of the steeper soils is in permanent pasture and meadow or is wooded.

Slope and moderate permeability to very slow permeability of the major soils are limitations for many nonfarm uses. Wet-season and year-round springs are common in this association. Slumping and poor soil stability are deterrents to excavation and other kinds of construction work. The sand and gravel that underlie Negley soils are generally suitable for commercial use.

12. Genesee-Algiers-Sardinia association

Deep, nearly level to sloping, well drained, somewhat poorly drained and moderately well drained soils that formed in alluvium or loess and the underlying water-deposited material

The soils of this association are nearly level to sloping and are along streams in the southern two-thirds of the county. The most extensive areas are along the North Fork and East Fork of White Oak Creek, Ohio Brush Creek, Clear Creek, and Rocky Fork Creek.

This association makes up about 3 percent of the county. It is about 40 percent Genesee soils, 35 percent Algiers soils, 8 percent Sardinia soils, and 17 percent minor soils.

Genesee soils are nearly level, light colored, and well drained. They formed in stream sediments on first bottoms.

Algiers soils are nearly level and somewhat poorly drained. They formed in 12 to 30 inches of light-colored, recent stream sediments underlain by dark-colored, very poorly drained soil material.

Sardinia soils are light colored, moderately well drained, and nearly level to sloping. They formed in silty deposits underlain by stratified material. These soils have a compact, brittle fragipan in the subsoil that impedes percolation of water. Along Clear and Rocky Fork Creeks, they are underlain by sand and gravel at a depth of 7 to 10 feet.

Minor soils in this association are Williamsburg, Fitchville, Patton, and Ross soils on terraces; and Shoals, Sloan, and Eel soils on first bottoms.

Seasonal flooding on Genesee and Algiers soils and the wetness of Algiers and Sardinia soils are major concerns in managing the soils of this association. Erosion is an additional hazard in the sloping areas of Sardinia soils. If flooding is controlled, where feasible, and Algiers soils are artificially drained, the Genesee and Algiers soils are among the best suited soils in the county for agriculture. Sardinia soils have a moderate productivity potential if artificial drainage and other improved management

practices are used in the nearly level to gently sloping areas and if erosion control practices are used in the sloping areas. The farms in this association are mostly general and cash–grain farms.

The flooding of major soils is a limitation for most nonfarm uses.

13. Fox-Genesee-Ross association

Deep, nearly level to moderately steep, well-drained soils that formed in stratified glacial outwash or recent alluvium

The soils of this association are mainly in the townships of Madison, Fairfield, and Paint in the northeastern part of the county. The areas are mainly nearly level to moderately steep, and they occur along Rattlesnake and Paint Creeks.

This association makes up about 2 percent of the county. It is about 20 percent Fox soils, 20 percent Genesee soils, 20 percent Ross soils, and 40 percent less extensive soils.

The light-colored, well-drained, nearly level to moderately steep Fox soils are on terraces. They are underlain by calcareous sand and gravel at a depth of 24 to 42 inches. The light-colored Genesee and the dark-colored Ross soils are nearly level and well drained. They formed in stream sediments on first bottoms. Ross soils are also on low terraces that are at a slightly higher elevation than the first bottoms.

Among the minor soils in the association are Ockley, Sleeth, Thackery, Westland, Casco, Wea, and Warsaw soils on the terraces; and Eel, Shoals, Sloan, and Algiers soils on the first bottoms.

The erosion hazard on sloping Fox soils and the periodic flooding on Genesee and Ross soils are the main concerns in managing this association. Droughtiness during dry periods is a limitation to the use of Fox soils. The soils of this association are among the best suited to farming if soil fertility is improved; flooding is controlled where feasible; and erosion is controlled in sloping areas. Genesee and Ross soils have a high productivity potential and Fox soils have a moderate productivity potential. If erosion control practices are used in sloping areas of the Fox soils, the major soils of this association are irrigable. The soils are well suited to truck crops, nursery crops, and small grains. Most of the farms in this association are general, cash grain, and dairy farms.

Fox soils on the higher terraces and uplands are suitable for homesites where slope is not limiting and natural drainage is good. Fox soils that are on the lower terraces adjacent to the flood plains and Genesee and Ross soils have severe limitations for homesites because of periodic flooding. The underlying sand and gravel in Fox and Ockley soils is suitable for commercial use.

Use and Management of the Soils

In the following pages, use and management of the soils for farming, woodland, wildlife, engineering, and town and country planning are described.

The section that discusses use and management for farming includes information related to special crops and estimated yields. The properties and soil features that affect engineering practices and the limitations that affect land use planning are enumerated mainly in tables.

Some principles of management are general enough to apply to all the soils suitable for farm crops and pasture throughout the county, even though one soil or groups of soils may require different kinds of management.

On many soils in the county, lime, fertilizer, or both are needed. The amount depends on the natural supply of lime and plant nutrients as determined by the results of laboratory analyses of soil samples and on the needs of the crop. Only general suggestions for the application of lime and fertilizer are given.

Management for cultivated crops and pasture

There are wide variations in the use and management of the soils in Highland County. Field crops, pasture, and special crops are grown. Information concerning suitable crop varieties, erosion control practices, and other management practices can be obtained from the local office of the Soil Conservation Service or from the Cooperative Extension Service.

Most of the soils of Highland County were never high in content of organic matter. Building up the content of organic matter is not economical, but it is important to add farm manure to the soil, leave plant residue on the soil surface, and grow sod crops, cover crops, and green-manure crops, and thus return organic matter to the soil.

Tillage tends to break down soil structure. It should be kept to the minimum necessary to prepare a seedbed and control weeds. Maintaining the organic-matter content of the plow layer also helps to protect the soil structure.

On Blanchester silt loam and other wet soils, yields of cultivated crops can be increased by the use of open ditch drainage or subsurface drainage. Subsurface drains are costly to install, but they generally provide better drainage. Soils that have a fragipan are difficult to drain, but they can generally be drained better by open ditches. Open ditch drainage is more effective where the ditches intercept water as it moves horizontally across the top of the fragipan. Suitable outlets are needed for both kinds of drainage.

All the soils that are gently sloping or steeper are subject to erosion if they are cultivated. Runoff and erosion occur mainly in fields where a cultivated crop is growing or where one has been recently harvested. On Rossmoyne silt loam, 2 to 6 percent slopes, and other erodible soils a cropping system that controls runoff and erosion combined with other erosion control practices is needed. In this survey, cropping system refers to the sequence of crops grown. Among the other management practices that should be combined with the use of a good cropping system are minimum tillage, mulch planting, use of crop residue, growth of cover crops and green-manure crops, and use of lime and fertilizer. Other erosion control measures that can be used are contour cultivation, terracing, contour stripcropping, diversion of runoff, and use of grassed waterways. The effectiveness of a particular combination of these measures differs from one soil to another, but other combinations can be equally effective on the same soil. The nearest office of the Soil Conservation Service can give further assistance.

Pasture is effective in controlling erosion on all but a few of the soils that are subject to erosion. For some soils a high level of pasture management is needed to provide enough ground cover to keep the soil from eroding. A

high level of pasture management provides for fertilization, control of grazing, selection of pasture seed mixtures, and other practices that are adequate to maintain good ground cover and forage for grazing. Grazing is controlled by rotating the livestock from one pasture to another and by resting the pasture after each grazing period to allow for the regrowth of plants. On some soils it is important that the pasture seed mixtures be selected so that the least amount of pasture is needed. They should also be selected for maintenance of good ground cover and forage for grazing.

Management for special crops

Special or high-value crops are important to farming in Highland County. Of these special crops, tobacco is the most important to the agriculture of the county. Among the other special crops are truck crops of sweet corn, cabbage, peppers, tomatoes, potatoes, and melons, as well as apples, peaches, pears, grapes, and other fruits, and nursery stock.

Special crops generally require fertile, productive soils. Because these crops require a more stable environment than field crops, they are better suited to some soils than to others.

About 560 acres of Burley tobacco in approximately 1,000 plots is grown annually in the county. Good drainage of both the surface layer and the subsoil is especially important in growing tobacco, which also needs 75 to 80 days of growth in a soil high in content of organic matter. The growing of a winter cover crop of rye or wheat and the spreading of manure increases the organic-matter content and controls erosion in fields used continuously for tobacco.

Tobacco yields are best on deep loamy soils that are moderately well drained or well drained, but tobacco can be raised on somewhat poorly drained soils if the soils are adequately drained. Very few, if any, soils in the county are naturally fertile enough to produce high yields of quality tobacco unless green cover crops, farm manure, and commercial fertilizer are plowed under.

Irrigation

Generally Highland County receives rainfall sufficient for most crop requirements, but periods when rainfall is below optimum are common. Supplemental irrigation benefits crops and pasture in dry periods. Irrigation is particularly beneficial in years when rainfall is less than normal. At present, only a small acreage is irrigated.

The soils in the county vary greatly in suitability for irrigation. Soils that are best suited to sprinkler irrigation are level to gently sloping and have a deep rooting zone. They also have favorable permeability and water-holding capacity and are easily kept in good tilth. The soil features that affect suitability for irrigation are natural drainage, texture of the surface layer, movement of air and water in the subsoil, and inherent fertility.

Some soils may be more productive if they are irrigated. Before any irrigation water is spread, the soils may have to be leveled to the desired grade so that they can be artificially drained.

Soils of the Fox, Genesee, Ockley, Ross, Russell, Warsaw, Wea, and Williamsburg series that have slopes of not more than 6 percent are well suited to irrigation. The nearly level and gently sloping soils of the Dana, Eel, Markland, Philo, Rossmoyne, Sardinia, Thackery, and Xenia series can be irrigated if necessary drainage is provided.

The rest of the soils in the county are not so well suited to irrigation because they are limited by excessive slope, a slow rate of water intake, surface crusting, limited available water capacity, or somewhat poor to very poor natural drainage.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for forest trees or engineering.

In the capability system, all kinds of soils are grouped at three levels; the capability class, subclass, and unit. These are discussed in the following paragraphs.

Capability Classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

- Class I soils have few limitations that restrict their use.
- Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.
- Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.
- Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.
- Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife habitat.
- Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.
- Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife habitat.
- Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, water supply, or to esthetic purposes.

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The

letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils that wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in some parts of the United States but not in Highland County, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, woodland, wildlife, or recreation.

In this county, the hazard of erosion (*e*) is the main limitation on about 65 percent of the acreage; wetness (*w*) is the main limitation on 33 percent; and droughtiness or shallowness (*s*) is the main limitation on 2 percent.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–3 or IIIe–2. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

Management by capability units

In the following pages the capability units in Highland County are described and suggestions for the use and management of the soils are given. The descriptions of the capability units give the general characteristics, properties, and qualities of the soils within the unit. One or two soils have been included in some capability units even though they have some properties that differ slightly from those of the rest of the soils in the group. Generally, the acreage is so low that a separate description of these soils is not justified.

No specific recommendations are given for overcoming limitations of soils because many different methods or combinations of management practices are suitable on any given soil.

CAPABILITY UNIT I-1

This capability unit consists of deep, nearly level, well drained and moderately well drained soils on uplands and terraces. These soils formed in a mantle of silt and the underlying limy glacial till or outwash. They have few limitations that restrict their use.

The surface layer is silt loam and is easily tilled. The available water capacity is medium to high, and the root zone is moderately deep or deep.

The main management concerns are maintaining high fertility and good soil structure. The soils in this capability unit are well suited to irrigation.

These soils are suited to all crops commonly grown in the county, including tobacco. Row crops can be grown continuously under optimum management. The soils are also well suited to grasses, legumes, and most shrubs, vines, and trees.

CAPABILITY UNIT IIe-1

This capability unit consists of deep or moderately deep, gently sloping, well drained or moderately well drained soils on uplands or terraces.

The available water capacity is medium to high in these soils. Permeability is generally moderate to moderately slow, but it is very slow in some places. The root zone is moderately deep to deep. Some soils are moderately deep to limestone, and some have a thick surface layer. Some of these soils are moderately eroded and consequently they are more difficult to till and manage.

The main concern of management is controlling erosion. Among the other concerns are maintaining high fertility, the content of organic matter, and good soil structure, particularly in the eroded soils. The soils are suited to sprinkler irrigation, but water application rates should be regulated to control erosion.

The soils in this unit are suited to tobacco and all other crops commonly grown in the county. Under optimum management they can be row cropped intensively if erosion is controlled. The soils are also well suited to grasses and legumes and most shrubs, vines, and trees.

CAPABILITY UNIT IIe-2

This capability unit consists of deep or moderately deep, gently sloping, moderately well drained to somewhat poorly drained soils on uplands and terraces.

The available water capacity is medium in these soils, and permeability is moderate to very slow. The root zone is moderately deep. Some of the soils have a layer of clay in the lower part of the subsoil, but most have a firm, compact subsoil. Some of the soils are moderately eroded, and consequently they are more difficult to till and manage.

The main management concern is controlling erosion. Among the other management concerns are maintaining high fertility, the content of organic matter, and good soil structure. The soils are suited to sprinkler irrigation, but water application rates should be low because permeability is slow and runoff is high.

The soils in this unit are suited to all crops commonly grown in the county, including tobacco. Under optimum management, they can be row cropped intensively if erosion is controlled. The soils are also well suited to grasses, legumes, and most shrubs and trees.

CAPABILITY UNIT IIe-3

This capability unit consists of deep, gently sloping, well-drained soils on terraces.

The surface layer is silt loam or loam. The soils are underlain by sand and gravel. The available water capacity is low to medium, and permeability is moderate to moderately rapid. These soils are some of the first to dry out in spring, and there is a drought hazard in dry years. The root zone is moderately deep to deep.

The main concern of management is controlling erosion. Among the other management concerns are maintaining soil structure, fertility, and the content of organic matter. The organic-matter content is important because it affects the available water capacity. These soils are suited to sprinkler irrigation, but water application rates should be regulated to control erosion.

The soils in this unit are suited to all crops commonly grown in the county, including tobacco. They are better suited to the early maturing varieties of corn and soybeans, because the available moisture supply is limited late in summer. Under optimum management they can be row cropped intensively if erosion is controlled. These soils are also well suited to grasses and legumes.

CAPABILITY UNIT IIe-4

This capability unit consists of deep and moderately deep, gently sloping, well drained or moderately well drained soils on uplands. These soils are underlain by acid shale. Some small areas are moderately eroded and consequently are more difficult to till and manage.

The available water capacity is medium to low, and permeability is slow to moderately slow. The root zone is moderately deep to deep.

The main management concerns are the control of erosion and maintaining lime requirements. Among the other management concerns are maintaining organic-matter content, soil structure, and fertility. These are very strongly acid soils, and relatively large amounts of lime are required to maintain an optimum reaction.

The soils in this unit are suited to all crops commonly grown in the county, including tobacco. Under optimum management, they can be row cropped intensively if erosion is controlled. The soils are also well suited to grasses, trees, shrubs, and vines. If an adequate liming program based on the results of soil tests is followed, they are also suited to legumes.

CAPABILITY UNIT IIw-1

This capability unit consists of moderately deep to deep, nearly level, somewhat poorly drained soils on flood plains. These soils are subject to flooding, and they have a seasonally high water table.

The available water capability is high, and permeability is moderate. The root zone is moderately deep to deep.

The main management concerns are the control of flooding and wetness. Among the other concerns are maintaining good soil structure and preventing deposition in some places. Tile drainage is effective if adequate outlets are provided. Surface drainage and diversions at the base of nearby slopes help reduce the wetness.

These soils are suited to most summer crops commonly grown in the county. Winter grain crops may be damaged by excess water as a result of flooding cr a high water table. Some form of artificial drainage is needed to produce optimum yields. The soils are also suited to grasses, legumes, and some trees, shrubs, and vines.

CAPABILITY UNIT IIw-2

This capability unit consists of deep, nearly level to gently sloping, somewhat poorly drained soils on uplands and terraces.

The available water capacity is medium to high, and permeability is slow to moderate. The root zone is moderately deep to deep.

The main management concerns are establishing drainage and controlling erosion. Among other management concerns are maintaining the content of organic matter, fertility, and soil structure. Tile drainage has proved effective in removing excess water from these soils. Surface ditches can also be used. Runoff from adjacent areas should be intercepted with diversions. Under optimum management, these soils can be intensively row cropped if erosion is controlled.

These soils are suited to all crops commonly grown in the county. Winter grain crops may be damaged because the water table is seasonally high. Yields for most crops, particularly tobacco and other special crops, are restricted, unless adequate drainage is provided. These soils are suited to grasses, legumes, and many varieties of trees, shrubs, and vines.

CAPABILITY UNIT IIw-3

This capability unit consists of deep, nearly level, moderately well drained soils on uplands and terraces. These soils have a firm compact layer in the subsoil.

The available water capacity is medium, and permeability is moderate. The root zone is moderately deep.

The main management concern is removal of excess water. Among other concerns are maintaining the content of organic matter, fertility, and soil structure. Erosion is generally not a concern. These soils are medium to very strongly acid, and relatively large amounts of lime may be required to maintain optimum reaction. Excess water can be controlled with optimum soil management. Surface drainage ditches are the most effective, but tile is not effective because of restricted permeability of the soil.

These soils are suited to tobacco and most crops commonly grown in the county. They are also suited to grasses, trees, shrubs, and vines. They are also suited to legumes if they are adequately limed.

CAPABILITY UNIT IIw-4

This capability unit consists of deep, nearly level, poorly drained or very poorly drained soils on uplands and terraces.

The surface layer is high in organic matter. If these soils are drained, the available water capacity is medium to high, and the root zone is moderately deep to deep. Permeability is slow to moderate.

The main management concerns are establishing drainage and maintaining good soil structure. These soils can be drained with tile. Diversions and waterways are also useful in removing excess water. These soils can be tilled only within a narrow range of moisture content. If the soils, particularly the silty clay loams, are worked when too wet, the structure breaks down and the soils become compact and cloddy. Crops respond favorably to artificial drainage.

These soils are suited to most crops commonly grown in the county. Under optimum management, they can be row cropped intensively. Winter grain crops may be damaged by excess water that results from ponding or a seasonally high water table. The soils are suited to grasses, legumes, and most trees, shrubs, and vines.

CAPABILITY UNIT IIw-5

This capability unit consists of deep, nearly level, well drained or moderately well drained soils on flood plains. These soils are subject to flooding, and some have a seasonally high water table. Generally they have a slightly acid root zone, but in a few places, a very strongly acid root zone. The available water capacity is high, and permeability is moderate to moderately slow. The root zone is moderately deep to deep.

The main concern of management is control of flooding, which often results in soil deposition or scouring. The control of erosion is generally not a problem on these soils. The soils in this unit are suited to irrigation.

The soils in this unit are suited to tobacco and all other crops commonly grown in the county. Under optimum management, they can be row cropped intensively. Winter grain may be damaged by excess water that results from flooding or a seasonally high water table. These soils are also suited to grasses, trees, shrubs, and vines. All soils in this unit are suited to legumes, except those that have a very strongly acid rooting zone. These soils require applications of lime if legumes are to grow satisfactorily.

CAPABILITY UNIT IIs-1

This capability unit consists of deep, nearly level, well-drained soils on uplands and terraces. These soils are underlain by sand and gravel.

The available water capacity is medium to low, and permeability is moderate above a substratum of sand and gravel. These soils are some of the first soils to dry out in spring, and they may be droughty in dry years. The root zone is moderately deep.

The main management concern is conservation of moisture. Among other concerns are maintaining fertility and the content of organic matter. The content of organic matter is important because it affects the available water capacity. Erosion is generally not a concern. Soils in this unit are well suited to irrigation.

The soils in this unit are suited to tobacco and all other crops commonly grown in the county. They are better suited to early maturing varieties of corn and soybeans than to other varieties because they have a limited supply of available moisture late in summer. Under optimum management, they can be row cropped intensively. The soils are also suited to grasses, legumes, trees, shrubs, and vines.

CAPABILITY UNIT IIs-2

Stonelick loam is the only soil in this capability unit. It is a well-drained, deep, nearly level soil on flood plains. It is subject to occasional flooding.

The available water capacity is low, and permeability is moderately rapid. The root zone is shallow. During dry years, crops are affected by a lack of moisture.

The main management concern is maintaining enough moisture for plants. Maintaining fertility and the content of organic matter helps to maintain enough moisture. The content of organic matter is important because it affects soil water retention and improves soil structure. Ordinarily erosion is not a problem. This soil is suited to irrigation.

This soil is suited to tobacco and all other crops commonly grown in the county. Winter grain may be damaged by excess water from flooding. This soil is also suited to grasses, legumes, trees, shrubs, and vines.

CAPABILITY UNIT IIIe-1

This capability unit consists of moderately deep and deep, sloping, moderately well drained or well drained soils on uplands and terraces.

The available water capacity is medium, and permeability is moderate to very slow. The root zone is moderately deep to deep.

All the soils in this unit are moderately eroded and consequently difficult to till and manage. The main management concern is controlling erosion, which is a severe hazard. Among the other management concerns are maintaining fertility, the organic-matter content, and good soil structure. Frequent use of small grains, grasses, and other close-growing crops helps in the control of erosion.

The soils in this unit are suited to most crops commonly grown in the county. Row cropping can be moderately intensive if optimum soil management is used. The soils are well suited to grasses and legumes and to most trees, shrubs, and vines.

CAPABILITY UNIT IIIe-2

This capability unit consists of deep, sloping, moderately well drained soils on uplands and terraces.

The available water capacity is medium, and permeability is moderate to slow. The root zone is moderately deep to deep. Some soils have a clayey layer in the lower part of the subsoil, and others have a firm, compact layer. Most of the soils in this unit are moderately eroded and consequently are more difficult to till and manage.

The major concern of management is controlling the erosion, which is a severe hazard. Among the other concerns are maintaining fertility, the organic matter content, and good soil structure. The soils are strongly to very strongly acid and require relatively large amounts of lime if optimum reaction is to be maintained. Row cropping can be moderately intensive if optimum management is used. Frequent use of small grain crops, grasses, and other close growing crops help in controlling erosion.

The soils in this unit are suited to most crops commonly grown in the county. They are also well suited to grasses and most trees, shrubs, and vines. If adequate amounts of lime have been applied according to the results of soil tests, these soils are suited to legumes.

CAPABILITY UNIT IIIe-3

This capability unit consists of deep, gently sloping to sloping, well drained or moderately well drained soils on the uplands, slack-water terraces, and lake plains.

The available water capacity is medium, and permeability is very slow to moderately slow. The root zone is moderately deep.

The main management concern is controlling erosion, which is a severe hazard. Among other concerns are maintaining fertility, the content of organic matter, and good soil structure. Some soils in this unit are moderately eroded and consequently more difficult to till and manage than less eroded soils. Frequent use of small grains, grasses, and other close-growing crops help in the control of erosion.

These soils are suited to most crops commonly grown in the county. Row cropping can be moderately intensive under optimum soil management. These soils are suited to grasses and legumes and most trees, shrubs, and vines.

CAPABILITY UNIT IIIe-4

This capability unit consists of deep, sloping, well-drained soils on terraces. They are underlain by sandy and gravelly material.

The available water capacity is medium to low, and permeability is moderate to moderately rapid. These

are some of the first soils tc be dry enough in spring to till, but they tend to be droughty during dry seasons. The root zone is moderately deep or deep.

The main management concerns are conserving moisture and controlling erosion, which is a severe hazard. Among other concerns are maintaining fertility, content of organic matter, and good soil structure. The content of organic matter is important because it affects the available water capacity. Erosion cannot be adequately controlled if management is less than optimum. Frequent use of small grain crops, grasses, and other close-growing crops help in the control of erosion.

The soils in this unit are suited to most of the crops commonly grown in the county. They are better suited to early maturing varieties of corn and soybeans than to other varieties because moisture supply is limited late in summer. These soils are also suited to grasses and legumes and most trees, shrubs, and vines. Row cropping can be moderately intensive if optimum management is used. Plants that require a large amount of water should not be used.

CAPABILITY UNIT IIIe-5

This capability unit consists of deep and moderately deep, sloping, well drained or moderately well drained soils on uplands.

The available water capacity is medium to low, and permeability is moderate to slow. The root zone is moderately deep to deep.

The major management concern is controlling erosion, which is a severe hazard. Among other concerns are maintaining fertility and the content of organic matter. The soils are very strongly acid and require relatively large amounts of lime to maintain optimum reaction. Frequent use of small grain crops, grasses, and other close-growing crops helps in controlling erosion.

The soils are suited to most crops commonly grown in the county. Row cropping can be moderately intensive if optimum management is used. The soils are suited to grasses, trees, and some shrubs and vines. Legumes and other plants that require a large amount of lime should not be used, unless adequate amounts of lime have been applied according to the results of soil tests.

CAPABILITY UNIT IIIw-1

This capability unit consists of deep, nearly level, somewhat poorly drained soils on uplands and slack-water terraces.

The available water capacity is medium, and permeability is very slow. The root zone is moderately deep. These soils have a firm, brittle, compact fragipan in the subsoil.

The main management concern is overcoming wetness. Among other management concerns are maintaining high fertility, the content of organic matter, and good soil structure. Erosion generally is not a hazard on these soils.

A system of surface ditches is the most effective means of removing excess water from these soils. Standard tile systems do not work well because of the fragipan. Under optimum management, these soils can be row cropped intensively. If less than optimum management is used, intensive row cropping can increase wetness by destroying organic matter and soil structure.

The soils in this unit are suited to most crops commonly grown in the county, but wetness restricts production. Excess water caused by a seasonal high water table damages winter grain crops. These soils are suited to grasses and most trees, shrubs, and vines. Because of the wetness, the trees tend to develop a shallow root system and thus are subject to windthrow. Plants that can tolerate wetness should be grown. The soils are very strongly acid, and unless lime has been applied according to the results of soil tests, plants that require a high content of lime should not be grown.

CAPABILITY UNIT IIIw-2

This capability unit consists of deep, gently sloping, somewhat poorly drained soils on uplands, slack-water terraces, and lake plains.

The available water table is medium, and permeability is slow to very slow. The root zone is moderately deep to deep.

The main concern of management is controlling wetness. The hazard of erosion is moderate on these soils. Among other concerns are maintaining fertility, the content of organic matter, and good soil structure.

A system of surface ditches is the most effective way of removing excess water. Standard tile systems do not work well because of the restricted soil permeability. Diversions can be used to intercept runoff from adjacent higher areas. The soils can be row cropped intensively under optimum management if erosion is controlled.

The soils in this unit are suited to most crops commonly grown in the county. Winter grain crops may be damaged by water that results from a seasonally high water table. Yields of most crops may be affected by wetness. These soils are also suited to grasses and most trees, shrubs, and vines. Only plants that tolerate wetness should be used.

CAPABILITY UNIT IIIw-3

This capability unit consists of deep to moderately deep, nearly level, very poorly drained soils on flood plains, lake plains, and uplands.

The surface layer is high in content of organic matter. If the soil is drained, the available water capacity is high, and the root zone is moderately deep to deep. Permeability is moderate to very slow.

The main concern of management is controlling wetness. Among other concerns are maintaining fertility, good soil structure, and on some soils, flooding.

Crops respond favorably to artificial drainage. Tile drains are seldom installed in these soils because of the limited availability of outlets in some soils, the narrow spacing required in some, and the depth to bedrock in others. Drainage can be improved if excess surface water is removed and diversions are used to intercept runoff from adjacent areas. Under optimum management, these soils can be row cropped intensively. The soils in this unit that have a surface layer of silty clay loam can be tilled only within a narrow range of moisture content. These soils become compact and cloddy if they are worked while wet.

These soils are suited to most crops commonly grown in the county. Winter grain crops may be damaged by the excess water resulting from ponding or a seasonally high water table. The soils are also suited to grasses, legumes, and most trees, shrubs, and vines. Plants that can tolerate wetness are best suited.

CAPABILITY UNIT IIIw-4

This capability unit consists of nearly level, deep, poorly drained soils on uplands and lake plains.

The available water capacity is medium, and permeability is very slow to slow. The root zone is moderately deep to deep.

The main concern of management is controlling wetness. Among other concerns are maintaining fertility, the content of organic matter, and good soil structure.

These soils can be drained with tile, but the tile must be closely spaced. Surface drainage and diversions are commonly used. Because these soils are medium acid to very strongly acid, they require relatively large amounts of lime for the growing of most crops. Under optimum management, the soils can be row cropped intensively. If less than optimum management is used, intensive row cropping can increase wetness by destroying organic matter and soil structure. Erosion is generally not a problem on these soils.

These soils are suited to most crops commonly grown in the county. They are best suited to early maturing varieties of soybeans and corn because of possible wetness at harvesttime. Winter grain crops often are damaged by excess water caused by a seasonally high water table. These soils are also suited to grasses and some trees, shrubs, and vines. Plants that are water tolerant are best suited. If an adequate amount of lime is applied according to the results of soil tests, some legumes can be grown.

CAPABILITY UNIT IVe-1

This capability unit consists of moderately deep to deep, sloping to moderately steep, well drained or moderately well drained soils on uplands, lake plains, and slack-water terraces.

The available water capacity is medium, and permeability is moderate to very slow. The root zone is moderately deep to deep. Because these soils are moderately and severly eroded, the surface layer is more clayey and is sticky when wet and hard when dry. Consequently, the soil is more difficult to till and manage. The soils are also shallow. They can be tilled only within a narrow range of moisture content. They are compact and cloddy if they are worked when too wet.

The main management concern is controlling erosion, which is a very severe hazard. Among other concerns are maintaining fertility, content of organic matter, and good soil structure. Row crops can be grown occasionally if optimum management is used, but erosion in cropped fields cannot be satisfactorily controlled if less than optimum management is used. Use of small grains and other close-growing crops helps in controlling erosion.

These soils are suited to most crops commonly grown in the county though some effect of past erosion should be expected. They are also suited to grasses, legumes, and most trees, shrubs, and vines. Plants that do not tolerate a large amount of lime do not grow well on some of the severely eroded soils that are limy at or near the surface.

CAPABILITY UNIT IVe-2

This capability unit consists of deep, sloping to moderately steep, well drained to moderately well drained soils on uplands, slack-water terraces, and lake plains.

The available water capacity is generally medium, but is low in severely eroded soils. Permeability is moderately slow to slow. The root zone is moderately deep. Most of these soils have a firm compact layer or fragipan in the subsoil.

The main management concern is controlling the erosion, which is a very severe hazard. Among other concerns are maintaining fertility, the content of organic matter, and good soil structure. Because these soils are moderately and severely eroded and consequently have a more clayey surface layer, they are more difficult to till and manage. The soils can be tilled only within a narrow range of moisture content. They become compact and cloddy if they are worked when too wet. Because these soils are medium acid to very strongly acid, they require relatively large amounts of lime to maintain an adequate reaction. Under optimum management, these soils can be row cropped occasionally, but if management is less than optimum, erosion cannot be adequately controlled in cropped areas. Small grains and other close growing crops help in controlling erosion.

These soils are suited to most crops commonly grown in the county. They are suited to grasses and most trees, shrubs, and vines. If an adequate amount of lime is applied according to the results of soil tests, these soils are suited to legumes.

CAPABILITY UNIT IVe-3

This capability unit consists of shallow to deep, sloping to moderately steep, well drained or moderately well drained soils on uplands, slack-water terraces, and lake plains.

The available water capacity is medium to low, and permeability is very slow to moderate. The root zone is shallow to deep. Because most of the soils in this unit are moderately or severely eroded, they have a shallower root zone and less available water capacity. The severely eroded soils have a more clayey surface layer and are sticky when wet and hard when dry. Consequently they are more difficult to till and manage. They can be worked only within a narrow range of moisture content. The surface layer becomes compact and cloddy if it is worked when too wet.

The main management concern is controlling erosion, which is a very severe hazard. Among other concerns are maintaining fertility, the content of organic matter, and good soil structure. The soils can be row cropped occasionally if optimum management is used, but erosion cannot be adequately controlled in cropped areas if optimum management is not used. Small grains, grasses, and other close-growing crops help in controlling erosion.

These soils are suited to most crops commonly grown in the county. They are suited to grasses, legumes, and most trees, shrubs, and vines.

CAPABILITY UNIT IVe-4

This capability unit consists of deep, sloping to moderately steep, well-drained soils on terraces and kames.

The available water capacity is low to medium in most areas but low in many eroded areas. Permeability is moderate to moderately rapid. The root zone is normally shallow because erosion has removed all or most of the original surface layer. The soils are underlain by gravel and sand.

The main management concerns are controlling erosion, which is a very severe hazard, and conserving water.

Because the severely eroded soils, especially those that have a more clayey surface layer, are sticky when wet and hard when dry, they are more difficult to till and manage. Among other concerns are maintaining fertility, the content of organic matter, and good soil structure. Organic matter is important because it affects soil structure and the available water capacity. The soils can be row cropped occasionally if optimum management is used, but erosion cannot be satisfactorily controlled in cropped areas if management is less than optimum. The use of small grains and grasses and other close-growing crops helps in controlling erosion.

These soils are suited to most crops commonly grown in the county. They are suited to growing grasses, legumes, and most trees, shrubs, and vines. Plants that need only a small amount of water are best suited.

CAPABILITY UNIT IVe-5

This capability unit consists of moderately deep to deep, sloping to steep, well drained to moderately well drained soils on uplands.

The available water capacity is medium to low, and permeability is moderate to slow. The root zone is moderately deep to deep.

The main management concern is controlling erosion, which is a very severe hazard, particularly on the soils that are steep. Among the other concerns are conserving soil water and maintaining fertility, the content of organic matter, and good soil structure. Because some of these soils are moderately eroded, they are more difficult to till and manage. The soils in this unit are very strongly acid and require relatively large amounts of lime to maintain an optimum reaction. Row crops can be grown occasionally on these soils if optimum management is used, but erosion cannot be adequately controlled if less than optimum management is used. Use of small grains and other close-growing crops helps in controlling erosion.

These soils are suited to most crops commonly grown in the county. They are also suited to grasses and most trees, shrubs, and vines. If adequate amounts of lime are applied according to the results of soil tests, the soils are suited to growing legumes; otherwise, plants that need large amounts of lime do not grow well on these soils.

CAPABILITY UNIT IVe-6

This capability unit consists only of soils on uplands. These soils are shallow to moderately deep, sloping, and moderately well drained to well drained.

The available water capacity is low to medium, and permeability is very slow to moderate. The root zone is shallow to moderately deep.

The main management concerns are controlling erosion, which is a very severe hazard, and maintaining good soil structure. Among other concerns are maintaining fertility, the content of organic matter, and soil structure. These soils can be tilled only within a narrow range of moisture content. Soil structure breaks down and the surface layer becomes compact and cloddy if they are worked when wet. These soils can be row cropped occasionally if optimum management is used, but erosion cannot be adequately controlled in cropped areas if less than optimum management is used. Use of small grains, grasses, and other close growing crops helps in controlling erosion.

These soils are suited to most crops commonly grown in the county. They are suited to growing grasses, legumes, and most trees, shrubs, and vines.

CAPABILITY UNIT VIe-1

This capability unit consists of shallow to deep, sloping to steep, well drained and moderately well drained soils on uplands, terraces, and lake plains.

The available water capacity is low to medium, and permeability is very slow to moderately rapid. The root zone is shallow to deep. Because some of these soils are so severely eroded that all or nearly all of the original surface layer is gone, they are shallower and the permeability is affected. Because they have a more clayey surface layer, that is sticky when wet and hard when dry, these severely eroded soils are more difficult to manage.

These soils are not suited to row crops, because the erosion hazard is very severe. Optimum management is needed during seeding operations to control erosion. Grazing should be regulated to maintain enough cover to control erosion. For optimum plant growth, lime and fertilizer should be applied according to the results of soils tests.

These soils are suited to most trees, shrubs, and vines that do not require a large amount of soil water. The soils are suited to most grasses and legumes commonly grown for permanent pasture.

CAPABILITY UNIT VIe-2

This capability unit consists of shallow to deep, moderately steep to very steep, and moderately well drained to well drained soils on uplands. These soils have a shallow to moderately deep rooting zone, low to medium available water capacity, and very slow to moderate permeability. All the soils are either moderately eroded or severely eroded. Thus, the root zone is thinner and the available water capacity is reduced. Because the severely eroded soils have a more clayey surface layer that is sticky when wet and hard when dry, they are more difficult to manage than the moderately eroded soils.

Because of the slope and depth of the soil and because of the very severe hazard of erosion, these soils are not suited to row crops. They are suited to most grasses and legumes commonly grown in the county for permanent pasture. Optimum management during seeding operations is needed to control erosion. Grazing should be regulated to maintain cover adequate for erosion control. For optimum yields, lime and fertilizer should be applied according to the results of soil tests.

CAPABILITY UNIT VIe-3

This capability unit consists of shallow to deep, steep to very steep, moderately well drained or well drained soils on the uplands. There are many stone fragments on the surface and throughout the soil. Bedrock outcrops are common.

The available water capacity is low to medium, and permeability is slow to moderately slow. The root zone is moderately deep to deep.

It is difficult and dangerous to operate modern farm machinery because these soils are stony and steep. Optimum management is needed to control erosion during seeding operations.

These soils are not suited to row crops, because of slope, stoniness, and erosion, which is a very severe hazard. They are suited to permanent pasture and woodland as well as to most grasses, trees, shrubs, and vines commonly grown in the county. The soils are suited to legumes commonly grown for permanent pasture if adequate lime has been applied according to the results of soils tests. Grazing should be regulated to maintain sufficient cover for erosion control.

CAPABILITY UNIT VIs-1

This capability unit consists of shallow to moderately deep, moderately steep to very steep, well-drained soils on the uplands.

The availabile water capacity is low to medium, and permeability is moderately rapid to slow. The root zone is shallow to moderately deep. In many areas there are numerous stone or shale fragments on the surface and throughout the soil.

These soils are not suited to cultivation, because of soil depth, degree of slope, stoniness, and erosion, which is a very severe hazard. The areas that can be fertilized, seeded, and mowed are suitable for pasture. The carrying capacity of pasture is low, particularly during dry seasons. Some areas are best suited to woodland.

CAPABILITY UNIT VIIe-1

This capability unit consists of deep, steep to very steep, well-drained soils on uplands, terraces, and kames.

The available water capacity is generally low, and permeability is moderately slow to moderately rapid. The root zone is shallow to moderately deep.

Most of these soils are too shallow and all are too steep for cultivation. Because the hazard of erosion is very severe the use of these soils for permanent vegetation is limited. Areas that can be fertilized, seeded, and mowed are suitable for pasture. These soils are suited to grasses and legumes commonly grown in the county for permanent pasture, but plant growth may be affected by limited available soil water. Areas that are too steep or rough for pasture are better suited to woodland.

CAPABILITY UNIT VIIe-2

This capability unit consists of moderately deep to deep, very steep, well-drained soils on uplands.

The available water capacity is low to medium, and permeability is moderate to moderately rapid. The root zone is moderately deep to deep. The soils are underlain by acid sandstone, and bedrock outcrops are common. There are stone fragments on the surface and throughout the soils.

On the soils in this unit, erosion is a very severe hazard. The soils are too stony and too steep for cultivation. Operating modern farm machinery on these soils is not safe. The use of these soils is limited to permanent vegetation. These soils have limited suitability for pasture but are generally better suited to woodland. They are suited to most trees that commonly are in the county.

CAPABILITY UNIT VIIs-1

This capability unit consists of shallow to moderately deep, very steep, well-drained soils on uplands.

The available water capacity is low to medium, and permeability is moderate to slow. The root zone is very shallow to moderately deep. There are many stone fragments on the surface and throughout the soil. Bedrock outcrops are common.

All of these soils are too steep, and most of them are too shallow and stony for cultivation. They are poorly suited to pasture. The soils are suited for woodland and wildlife if optimum management is used.

Estimated Yields

Table 1 shows, for most of the soils in the county, the estimated average acre yields of principal crops. The yields are the averages of those expected over a period of several years under two levels of management. Some of the soils are not listed because they are not suited to the crops rated. Also excluded are land types, such as Urban land.

The estimates of yields given in table 1 are based mainly on information obtained from farmers and on observations and field trials made by the county agent and district conservationists of the Soil Conservation Service. They are also based on experiments made by the Ohio Agricultural Research and Development Center and on field observations made by members of the soil survey party.

In table 1, yields in columns A are obtained under improved management and those in columns B are obtained under optimum management. Under an optimum level of management:

1. Practices are used that increase the intake of water and the water-holding capacity of the soils. Excess water is disposed of by appropriate means.
2. Practices are used to help control erosion.
3. Suitable methods of plowing, preparing the seedbed, and cultivation are used.
4. Weeds, diseases, and insects are controlled.
5. Fertility is maintained at the highest level. Lime and fertilizer are applied according to needs of the soil and crop. The fertilizer contains trace elements (zinc, cobalt, manganese, copper, and the like) if they are needed.
6. Crop varieties that are suited to the soil are selected.
7. All farming operations are done at the proper time and in the proper way.

In an improved level of management the farmer uses some, but not all, of the practices listed under optimum management, or the practices used are not adequate for the needs of the crops.

The yields given in table 1 do not apply to a specific field for any particular year, because the soils vary from place to place, management practices vary from farm to farm, and weather conditions are variable from year to year.

These yields are intended only as a guide that shows relative productivity of the soils, the response of soils to management, and the relationship of soils to each other. Although the general level of crop yields may change as new methods and new crop varieties are developed, the relationship of the soils to each other is not likely to change.

TABLE 1.—*Estimated average yields per acre of principal crops under two levels of management*

[Yields in columns A are based on improved management, and those in columns B are based on optimum management. See the text for definitions of those levels of management. Dashes indicate that the soil is not suited to the particular crop or that the crop is not commonly grown on the soil. Soils that are not suited to the crops in the table are not listed. Urban land also is not listed]

Soil	Corn		Soybeans		Wheat		Grass-legume hay	
	A	B	A	B	A	B	A	B
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*
Algiers silt loam	105	125	30	40	34	44	3.0	5.0
Atlas silt loam, 2 to 6 percent slopes	70	110	26	36	30	42	2.8	4.0
Atlas silt loam, 2 to 6 percent slopes, moderately eroded	65	100	24	34	28	38	2.8	4.0
Atlas silt loam, 6 to 12 percent slopes, moderately eroded	60	95			26	36	2.6	3.8
Atlas silt loam, 6 to 12 percent slopes, severely eroded					22	30	2.4	3.4
Avonburg silt loam, 0 to 2 percent slopes	75	110	26	36	32	44	2.8	4.0
Avonburg silt loam, 2 to 6 percent slopes	70	110	26	36	30	42	2.8	4.0
Beasley silt loam, 6 to 12 percent slopes, moderately eroded	60	75			28	36	2.8	3.6
Beasley silt loam, 12 to 18 percent slopes, moderately eroded					24	30	2.6	3.2
Berks-Muskingum channery silt loams, 18 to 35 percent slopes							2.0	2.6
Berks-Muskingum-Neotoma channery silt loams, 6 to 18 percent slopes							2.0	2.6
Blanchester silt loam	90	110	26	34	32	44	3.0	4.8
Boston-Bratton complex, 6 to 12 percent slopes, moderately eroded	80	100			30	40	3.4	4.6
Boston-Bratton complex, 6 to 12 percent slopes, severely eroded	60	70			18	25	3.0	4.0
Boston-Bratton complex, 12 to 18 percent slopes, moderately eroded							3.2	4.0
Boston-Bratton complex, 12 to 18 percent slopes, severely eroded							2.6	3.6
Boston-Bratton complex, 18 to 25 percent slopes, moderately eroded							2.6	3.6
Boston-Grayford silt loams, 2 to 6 percent slopes	70	95	20	24	30	40	3.0	4.2
Boston-Grayford silt loams, 2 to 6 percent slopes, moderately eroded	65	90	18	22	26	36	2.8	4.0
Bratton silt loam, 2 to 6 percent slopes	85	105	28	36	30	46	3.6	4.6
Bratton silt loam, 2 to 6 percent slopes, moderately eroded	80	95	24	30	26	40	3.4	4.4
Bratton silt loam, 6 to 12 percent slopes, moderately eroded	70	90			24	40	3.4	4.4
Bratton silt loam, 12 to 18 percent slopes, moderately eroded							3.0	4.0
Brookston silt loam	100	120	36	42	36	48	3.8	5.0
Brookston silty clay loam	105	120	36	42	36	48	3.8	5.0
Cana silt loam, 2 to 6 percent slopes	65	85			28	38	2.6	3.6
Cana silt loam, 6 to 12 percent slopes, moderately eroded	60	80			26	36	2.4	3.4
Cana silt loam, 12 to 18 percent slopes, moderately eroded							2.2	3.2
Celina silt loam, 2 to 6 percent slopes	90	105	32	40	36	46	3.6	4.8
Celina-Xenia silt loams, 0 to 2 percent slopes	95	110	34	42	38	46	3.6	4.8
Celina-Xenia silt loams, 2 to 6 percent slopes	90	105	32	40	36	46	3.6	4.8
Cincinnati silt loam, 2 to 6 percent slopes	80	110	26	36	30	46	3.4	4.4
Cincinnati silt loam, 6 to 12 percent slopes, moderately eroded	65	90			22	38	3.0	4.2
Cincinnati silt loam, 12 to 18 percent slopes, moderately eroded							2.0	3.8
Clermont silt loam	65	100	24	34	22	34	2.8	4.0
Colyer-Trappist complex, 12 to 18 percent slopes, moderately eroded							1.0	2.5
Crosby silt loam, 0 to 2 percent slopes	80	115	30	46	36	46	3.0	5.0
Crosby-Fincastle silt loams, 0 to 2 percent slopes	80	115	30	46	36	46	3.0	5.0
Crosby-Fincastle silt loams, 2 to 6 percent slopes	80	110	30	46	34	44	3.0	5.0
Dana silt loam, 0 to 2 percent slopes	80	120	26	44	36	50	3.8	4.8
Dana silt loam, 2 to 6 percent slopes	75	115	26	42	32	48	3.8	4.8
Dubois silt loam, 0 to 2 percent slopes	55	95	18	34	22	36	2.6	4.4
Dubois silt loam, 2 to 6 percent slopes	55	90	18	34	22	36	2.6	4.4
Edenton silt loam, 6 to 12 percent slopes, moderately eroded	60	85			24	36	3.6	4.4
Edenton silt loam, 12 to 18 percent slopes, moderately eroded							1.5	3.2
Eel silt loam	85	130	36	46	28	44	3.8	5.2
Fitchville silt loam, 0 to 2 percent slopes	90	110	28	36	28	38	3.4	4.4
Fitchville silt loam, 2 to 6 percent slopes	85	100	26	36	30	38	3.4	4.4
Fox loam, 6 to 12 percent slopes, moderately eroded	65	90			28	38	3.0	4.4
Fox loam, 12 to 18 percent slopes, moderately eroded							3.0	4.4
Fox silt loam, 0 to 2 percent slopes	65	90	20	30	28	38	3.0	4.4
Fox silt loam, 2 to 6 percent slopes	65	90	20	30	28	38	3.0	4.4

TABLE 1.—*Estimated average yields per acre of principal crops under two levels of management*—Continued

[Yields in columns A are based on improved management, and those in columns B are based on optimum management. See the text for definitions of those levels of management. Dashes indicate that the soil is not suited to the particular crop or that the crop is not commonly grown on the soil. Soils that are not suited to the crops in the table are not listed. Urban land also is not listed]

Soil	Corn		Soybeans		Wheat		Grass-legume hay	
	A	B	A	B	A	B	A	B
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*
Fox clay loam, 6 to 12 percent slopes, severely eroded					22	32	2.6	3.8
Gasconade silty clay loam, 6 to 12 percent slopes							1.8	2.8
Gasconade silty clay loam, 12 to 18 percent slopes, moderately eroded							1.6	2.6
Genesee silt loam	90	130	36	46	30	46	3.8	5.2
Guernsey silt loam, 2 to 6 percent slopes	85	100			26	36	3.0	4.0
Guernsey silt loam, 6 to 12 percent slopes	80	90			26	36	2.8	4.0
Guernsey silty clay loam, 6 to 12 percent slopes, severely eroded							2.0	2.8
Guernsey soils, 12 to 18 percent slopes, severely eroded							2.0	2.8
Haubstadt silt loam, 0 to 2 percent slopes	85	110	24	34	30	40	2.4	4.4
Haubstadt silt loam, 2 to 6 percent slopes	85	110	24	34	30	40	3.4	4.4
Haubstadt silt loam, 6 to 12 percent slopes, moderately eroded	80	90			22	30	3.2	4.2
Haubstadt silt loam, 6 to 12 percent slopes, severely eroded	60	70			14	20	2.0	3.2
Haubstadt silt loam, 12 to 18 percent slopes, moderately eroded							2.4	3.4
Haubstadt silt loam, 12 to 18 percent slopes, severely eroded							1.8	3.0
Hickory silt loam, 6 to 12 percent slopes, moderately eroded	65	85			22	30	2.8	3.8
Hickory silt loam, 12 to 18 percent slopes, moderately eroded							2.4	3.4
Hickory silt loam, 18 to 25 percent slopes, moderately eroded							2.2	3.2
Hickory clay loam, 6 to 12 percent slopes, severely eroded	50	60			18	24	2.2	3.2
Hickory clay loam, 12 to 18 percent slopes, severely eroded							2.0	3.0
Jessup silt loam, 12 to 18 percent slopes							2.6	3.6
Johnsburg silt loam, 2 to 8 percent slopes	60	85	18	28	20	36	2.8	3.8
Kendallville silt loam, 2 to 6 percent slopes	90	110	26	36	36	46	3.5	4.5
Kendallville silt loam, 6 to 12 percent slopes, moderately eroded	80	105	22	32	30	40	3.0	4.0
Kendallville silt loam, 12 to 18 percent slopes, moderately eroded							2.6	3.6
Kendallville clay loam, 12 to 18 percent slopes, severely eroded							2.0	2.8
Lawshe silty clay loam, 2 to 6 percent slopes	60	75			22	32	2.0	3.0
Lawshe silty clay loam, 6 to 12 percent slopes, moderately eroded	50	65			18	28	1.8	2.8
Lawshe silty clay loam, 12 to 18 percent slopes, moderately eroded							1.6	2.6
Lawshe silty clay loam, 12 to 18 percent slopes, severely eroded							1.4	2.4
Loudon silt loam, 2 to 6 percent slopes	85	95	30	38	34	44	3.0	4.0
Loudon silt loam, 2 to 6 percent slopes, moderately eroded	80	90	28	36	32	42	2.8	3.8
Loudon silt loam, 6 to 12 percent slopes, moderately eroded	75	85			30	38	2.6	3.6
Loudon silt loam, 12 to 18 percent slopes, moderately eroded							2.4	3.4
Markland silt loam, 2 to 6 percent slopes	75	110	30	36	30	46	3.0	4.4
Markland silt loam, 6 to 12 percent slopes, moderately eroded	60	85			28	40	2.6	3.8
Markland silt loam, 12 to 18 percent slopes, moderately eroded							2.4	3.4
McGary silt loam, 0 to 4 percent slopes	60	90	22	34	32	40	3.6	4.6
Miamian silt loam, 2 to 6 percent slopes	90	105	26	36	36	46	3.5	4.5
Miamian silt loam, 2 to 6 percent slopes, moderately eroded	85	100	24	34	34	44	3.5	4.5
Miamian silt loam, 6 to 12 percent slopes, moderately eroded	75	100	28	32	30	40	3.5	4.5
Miamian silt loam, 12 to 18 percent slopes, moderately eroded							3.0	4.0
Miamian silt loam, 18 to 25 percent slopes							2.6	3.6
Miamian clay loam, 6 to 12 percent slopes, severely eroded	60	75					2.4	3.4
Miamian-Russell silt loams, 2 to 6 percent slopes	90	105	26	36	36	46	3.6	4.6
Miamian-Russell silt loams, 2 to 6 percent slopes, moderately eroded	85	100	24	34	34	44	3.6	4.6
Miamian-Russell silt loams, 6 to 12 percent slopes, moderately eroded	75	100			30	40	3.6	4.6
Millsdale silty clay loam	85	100	36	40	36	48	3.6	4.6
Milton silt loam, 2 to 6 percent slopes	80	90	22	30	30	40	3.0	4.0
Milton silt loam, 2 to 6 percent slopes, moderately eroded	75	85	20	30	28	40	3.0	4.0
Milton silt loam, 6 to 12 percent slopes, moderately eroded	65	75			26	36	2.4	3.2

TABLE 1.—*Estimated average yields per acre of principal crops under two levels of management*—Continued

[Yields in columns A are based on improved management, and those in columns B are based on optimum management. See the text for definitions of those levels of management. Dashes indicate that the soil is not suited to the particular crop or that the crop is not commonly grown on the soil. Soils that are not suited to the crops in the table are not listed. Urban land also is not listed]

Soil	Corn		Soybeans		Wheat		Grass-legume hay	
	A	B	A	B	A	B	A	B
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*
Milton silt loam, 12 to 18 percent slopes, moderately eroded							2.2	2.4
Milton clay loam, 6 to 12 percent slopes, severely eroded							2.0	2.4
Montgomery silty clay loam	95	110	32	38	32	44	3.8	4.8
Negley loam, 6 to 12 percent slopes	70	90			28	36	2.0	3.0
Negley loam, 12 to 18 percent slopes							1.8	2.8
Negley silt loam, 2 to 6 percent slopes	85	100	26	36	30	40	2.4	3.4
Negley clay loam, 6 to 12 percent slopes, severely eroded	50	60			20	30	1.4	2.2
Negley clay loam, 12 to 18 percent slopes, severely eroded							1.6	2.0
Nicholson silt loam, 2 to 6 percent slopes	70	100	26	40	30	42	3.2	4.4
Nicholson silt loam, 2 to 6 percent slopes, moderately eroded	65	95	24	38	28	40	3.0	4.2
Nicholson silt loam, 6 to 12 percent slopes, moderately eroded	65	95			24	38	2.8	4.0
Ockley silt loam, 0 to 2 percent slopes	90	110	30	46	36	46	3.2	4.6
Ockley silt loam, 2 to 6 percent slopes	90	105	28	44	36	46	3.2	4.6
Ockley silt loam, 6 to 12 percent slopes, moderately eroded	85	95	26	40	34	44	3.0	4.4
Opequon silt loam, 6 to 18 percent slopes, moderately eroded							1.5	2.5
Opequon clay loam, 6 to 18 percent slopes, severely eroded							1.2	2.0
Otwell silt loam, 2 to 6 percent slopes	85	95	28	32	30	38	3.0	4.0
Otwell silt loam, 6 to 12 percent slopes, moderately eroded	80	90			28	36	3.0	3.8
Otwell silt loam, 12 to 18 percent slopes, moderately eroded					22	30	2.8	3.6
Patton silt loam	105	120	36	42	36	48	3.8	5.0
Patton silt loam, till substratum	100	120	34	42	34	46	3.8	5.0
Peoga silt loam	55	80	18	24	22	30	2.0	3.0
Philo silt loam	65	105	22	30	20	40	3.5	4.5
Ross silt loam	95	130	38	48	32	48	3.8	5.2
Rossmoyne silt loam, 0 to 2 percent slopes	75	105	26	36	30	42	2.8	4.2
Rossmoyne silt loam, 2 to 6 percent slopes	80	105	28	38	30	44	3.4	4.2
Rossmoyne silt loam, 2 to 6 percent slopes, moderately eroded	70	105	26	36	28	42	2.8	4.2
Rossmoyne silt loam, 6 to 12 percent slopes, moderately eroded	60	95			26	38	2.6	3.8
Rossmoyne silt loam, 12 to 18 percent slopes, moderately eroded							2.6	3.8
Rossmoyne silty clay loam, 6 to 12 percent slopes, severely eroded	45	70			18	26	1.8	2.8
Russell silt loam, 2 to 6 percent slopes	85	105	24	36	34	46	3.4	4.6
Sardinia silt loam, 0 to 2 percent slopes	75	110	26	38	32	44	3.0	4.2
Sardinia silt loam, 2 to 6 percent slopes	75	110	26	38	30	42	3.0	4.2
Sardinia silt loam, 6 to 12 percent slopes, moderately eroded	70	100			28	40	2.8	3.8
Shoals silt loam	75	110	26	40	28	42	3.2	4.5
Sleeth silt loam, 0 to 2 percent slopes	70	100	26	36	26	40	2.8	4.4
Sloan silt loam	105	120	36	42	34	46	4.0	5.0
Stonelick silt loam	70	90	20	30	30	40	3.0	4.0
Thackery silt loam, 0 to 2 percent slopes	100	115	28	38	30	40	3.5	4.8
Thackery silt loam, 2 to 6 percent slopes	95	110	26	36	28	40	3.5	4.8
Trappist-Muse silt loams, 2 to 6 percent slopes	45	75	20	26	18	30	1.6	3.2
Trappist-Muse silt loams, 6 to 12 percent slopes, moderately eroded	40	70			16	28	1.6	3.0
Trappist-Muse silt loams, 12 to 18 percent slopes, moderately eroded							1.4	2.8
Tuscarawas channery silt loam, 6 to 18 percent slopes	50	65			18	30	1.6	3.2
Warsaw silt loam, 0 to 2 percent slopes	75	110	24	36	36	48	3.0	5.0
Wea silt loam, 0 to 2 percent slopes	85	120	36	46	40	50	4.0	5.5
Wea silt loam, 2 to 6 percent slopes	80	115	30	40	36	48	4.0	5.5
Wellston silt loam, 6 to 12 percent slopes	80	95			30	40	3.5	4.5
Wellston silt loam, 12 to 18 percent slopes					24	36	2.8	4.0
Westland silt loam, overwash	80	120	28	42	26	46	3.0	5.0
Westland silty clay loam	85	120	28	42	26	46	3.0	5.0
Williamsburg silt loam, 0 to 2 percent slopes	85	115	32	42	36	46	3.4	4.5
Williamsburg silt loam, 2 to 6 percent slopes	80	115	30	40	30	46	3.2	4.5
Williamsburg silt loam, 6 to 12 percent slopes	70	100	22	30	26	40	2.0	4.0
Xenia silt loam, 2 to 6 percent slopes	90	110	32	40	36	46	3.6	4.6

Use of the Soils for Woodland [3]

In the early settlement of Highland County, it was necessary to remove the virgin forest which covered the county. Today mostly regrowth forest occupies approximately 84,000 acres, or about 25 percent of the total land area in Highland County. Much of this acreage has been or is being pastured. Very little regrowth or reforestation is occurring in the pastured woodland. The proximity of metropolitan areas makes the development of outdoor open space for income-producing recreational use a practical consideration. Woodland, potentially a multiple use resource, looms even larger in importance when viewed in this context.

Much can be said about the natural beauty of the county because of its woodland. Native redbud and dogwood bloom in the spring and present a panorama of natural beauty. The steep hillsides, winding streams, and narrow township roads come alive with color in autumn as the sweetgum, maple, dogwood, and sassafras seem to blaze with many hues of red, yellow, and brown.

Highland County is within the north-central hardwood forest region. Species such as black and red oaks, pin and white oaks, ash, beech, and sugar maple grow throughout the county.

Beech-maple is the dominant forest type and grows on the better drained soils. Associated species are yellow-poplar, white ash, white oak, red maple, basswood, wild cherry, sweetgum, sassafras, pin oak, and shagbark hickory.

The oak-hickory and beech-maple forest types are represented locally on the well-drained soils of the river valleys, stream terraces, and ridge tops. The virtual elimination of American chestnut by the blight has left the oaks predominant in the original chestnut-oak forest areas. Associated species include the hickories and sugar maple.

The flat, wet areas of the Illinoian glacial till plain are occupied by several swamp forest species such as pin oak, sweetgum, white elm, and red maple. Dutch elm disease is slowly eliminating the elm. Other species of minor occurrence include sassafras, beech, and red oak. Most of the farm woodlots on the wet soils are pastured. Some cropland fields have been abandoned and are now reverting to woodland. These wet areas have a thick, even-age, volunteer growth of young red maple, pin oak, and sweetgum trees.

On the eroded steep hillsides that are shallow to limy glacial till or shale and limestone bedrock, red cedars flourish. They have little competition from other tree species. They sometimes occur sparsely on the flat, wet, acid, till plain areas.

On the less eroded valley slopes, a second growth of black locust has covered many acres. Numerous old beech trees appear scattered in woodlots all over the county because they were left uncut when the more desirable species were harvested.

The soils of Highland County are interpreted by woodland suitability groups to assist owners in planning the use of their soils for woodland. Each group consists of similar soils that are suited to the same kinds of trees, need similar management, and have the same potential production for wood crops.

Each woodland group is identified by a three-part symbol, such as 1o1, 2w1, or 3c2. The potential productivity of the soils in the group is indicated by the first number in the symbol: 1 and 2—good; 3—fair; 4 and 5—poor. These average ratings are based on field measurements of tree site index for principal soils within each group. Site index of a given soil is the height, in feet, that the dominant and codominant trees of a given species reach in a natural, undisturbed stand in 50 years. Other publications give a more complete discussion of site index and potential productivity (*5, 7, 8, 11*).

The second part of the symbol identifying a woodland group is a small letter *x, w, d, c, f, r,* or *o*. The small letter indicates an important soil property that imposes a hazard or limitation in managing the soils of the group for trees. The letter *x* shows that the soils have limitations because of stoniness. The letter *w* means excessive wetness, either seasonal or all year. The letter *d* shows that the main limitation is restricted rooting depth. The letter *c* stands for clayey soils. The letter *f* shows that the soils have limitations of available water capacity due to large amounts of coarse fragments within the soil profile. The letter *r* shows that the main limitation is steep slopes and that there is a hazard of erosion and possible limitations to use of equipment. The letter *o* indicates few, if any, limitations that restrict use of the soils for trees. Priority in assigning the small letters designating the limiting features is in the order that the letters are listed above.

The last part of the symbol, another number, differentiates woodland suitability groups that have identical first and second parts in their identifying symbol. Soils in woodland group 2w1, for example, require somewhat different management than soils in group 2w2.

In table 2 each woodland suitability group in the county is rated for potential productivity, and site indexes are given for the principal species. The groups are also rated for various management hazards or limitations. Also, suitable tree species are listed for each woodland group. The hazards and limitations that affect management are defined in the following paragraphs.

Erosion hazard refers to the potential hazard of soil loss if vegetation is disturbed or removed. The hazard is slight if expected soil losses are small; moderate if soil losses are expected and care is needed during logging and construction to reduce losses; severe if special methods of operation are necessary for preventing excessive soil losses.

Equipment limitations depend on soil characteristics that restrict or prohibit the use of mechanical equipment, either seasonally or continually. Slight means no restrictions in the kind of equipment or time of year it is used; moderate means that use of equipment is restricted for 3 months of the year or less; severe means that special equipment is needed and that its use is severely restricted for more than 3 months of the year.

Seedling mortality refers to mortality of naturally occurring or planted tree seedlings, as influenced by kinds of soil or topographic conditions when plant competition is assumed not to be a factor. Slight means a loss of 0 to 25 percent; moderate means a loss of 25 to 50 percent; and severe means a loss of more than 50 percent in the seedlings. It is assumed that seed supplies are adequate.

[3] A. N. QUAM, woodland conservationist, Soil Conservation Service, helped to prepare this section.

TABLE 2.—*Woodland*

Woodland suitability group	Potential productivity			Hazards and limitations that affect management		
	Rating	Kinds of trees	Site index[1]	Erosion hazard	Equipment limitations	Seedling mortailty
			Ft			
Group 1o1	Good	Upland oak	85+	Slight	Slight	Slight
		Yellow-poplar	95+			
		Sugar maple	85+			
Group 2o1	Good	Upland oak	75–85	Slight	Slight	Slight
Group 2r1	Good	Upland oak	75–85	Moderate	Moderate	Slight
Group 2c1	Good	Upland oak	75–85	Slight	Moderate	Slight
Group 2c2	Good	Upland oak	75–85	Severe	Severe	Moderate
Group 2w1	Good	Wetland oak	80–90	Slight	Severe	Severe
Group 2w2	Good	Wetland oak	80–90	Moderate	Moderate	Moderate
		Upland oak	75–85			
		Yellow-poplar	85–95			
		Sugar maple	75–85			
		White pine	85–95			
Group 2w3	Good	Upland oak	75–85	Severe	Moderate	Slight
Group 3o1	Fair	Upland oak	65–75	Slight	Slight	Slight
		Yellow-poplar	75–85			
		White pine	75–85			
Group 3r1	Fair	Upland oak	65–75	Moderate	Moderate	Slight
Group 3f1	Fair	Upland oak	65–75	Slight	Moderate	Moderate
Group 3c1	Fair	Upland oak	65–75	Slight	Moderate	Slight
Group 3c2	Fair	Upland oak	65–75	Moderate	Severe	Slight
Group 3w1	Fair	Upland oak	65–75	Slight	Moderate	Slight
Group 3x1	Fair	Upland oak	65–75	Moderate	Severe	Slight
Group 4f1	Poor	Upland oak	55–65	Moderate	Moderate	Moderate
Group 4f2	Poor	Upland oak	55–65	Severe	Severe	Moderate
Group 4d1	Poor	Upland oak	55–65	Slight	Slight	Severe

See footnote at end of table.

interpretations

Hazards and limitations that affect management—Con.			Trees to favor in existing stands	Suitable trees for planting
Plant competition		Windthrow hazard		
Conifers	Hardwoods			
Severe	Moderate	Slight	Red oak, white oak, black oak, yellow-poplar, black walnut, sugar maple, white ash, eastern white pine.	Black walnut, yellow-poplar, white ash, eastern white pine, Norway spruce.
Severe	Moderate	Slight	Black walnut, yellow-poplar, northern red oak, white oak.	Black walnut, yellow-poplar, eastern white pine.
Severe	Moderate	Slight	Black walnut, yellow-poplar, northern red oak, white oak, Virginia pine.	Black walnut, yellow-poplar, eastern white pine, Virginia pine.
Severe	Moderate	Slight	Yellow-poplar, black walnut, northern red oak, white oak, white ash.	Black walnut, tulip poplar, eastern white pine.
Severe	Moderate	Slight	Yellow-poplar, black walnut, northern red oak, white oak, white ash.	Yellow-poplar, black walnut, eastern white pine.
Severe	Severe	Severe	White ash, red maple, bur oak, swamp white oak, pin oak, sycamore.	White ash, red maple, cottonwood, sycamore.
Severe	Severe	Moderate	Northern red oak, swamp white oak, white ash, sycamore.	Cottonwood, sycamore, white ash.
Severe	Severe	Slight	Northern red oak, yellow-poplar, white ash, red maple.	Eastern white pine, yellow-poplar Virginia pine.
Moderate	Slight	Slight	Northern red oak, white oak, yellow-poplar, black walnut.	White pine, yellow-poplar, Virginia pine.
Moderate	Slight	Slight	Northern red oak, white oak, yellow-poplar, black walnut, chesnut oak.	Eastern white pine, Virginia pine, yellow-poplar.
Moderate	Slight	Slight	White oak, black oak, chesnut oak, Virginia pine.	Virginia pine.
Moderate	Slight	Slight	Northern red oak, white oak, black oak, yellow-poplar.	Eastern white pine, Virginia pine, tulip-poplar.
Moderate	Slight	Slight	Northern red oak, white oak, black oak, yellow-poplar, chesnut oak.	Virginia pine, eastern white pine, yellow-poplar.
Moderate	Slight	Slight	Northern red oak, white oak, black walnut, red maple.	Eastern white pine, yellow-poplar, white ash.
Moderate	Slight	Slight	White oak, northern red oak, black oak, chestnut oak, Virginia pine.	Eastern white pine, Virginia pine.
Slight	Slight	Slight	Red oak, white oak, chestnut oak	Eastern white pine, Virginia pine.
Slight	Slight	Slight	Northern red oak, white oak, chestnut oak.	Eastern white pine, Virginia pine.
Slight	Slight	Moderate	Black oak, white oak, chestnut oak, shortleaf pine, Virginia pine.	Eastern redcedar, shortleaf pine, Virginia pine.

TABLE 2.—*Woodland*

Woodland suitability group	Potential productivity			Hazards and limitations that affect management		
	Rating	Kinds of trees	Site index [1]	Erosion hazard	Equipment limitations	Seedling mortailty
Group 4d2	Poor	Upland oak	55–65	Severe	Severe	Severe
Group 4w1	Poor	Upland oak	55–65	Slight	Moderate	Slight
Group 4x1	Poor	Upland oak	55–65	Moderate	Severe	Severe
Group 5d1	Poor	Upland oak	45–65	Severe	Severe	Severe

[1] Site index limits are based upon data gathered for individual soils in Ohio and adjoining states. Site index represents the average height that the dominant and co-dominant trees probably will attain at age 50 years.

Plant competition is the degree to which undesired plants invade new openings in the tree canopy. Considered in the ratings are available water capacity fertility, drainage, and degree of erosion. Conifers and hardwoods are rated separately in table 2. Slight means that plant competition does not prevent adequate natural regeneration and early growth or interfere with seedling development; moderate means that competition delays natural or artificial establishment and growth rate, but does not prevent the development of fully stocked normal stands; severe means that competition prevents adequate natural or artificial regeneration unless the site receives unusual preliminary preparation practices and continued early maintenance.

Windthrow hazard depends on the soil characteristics that enable trees to resist being blown down by wind. Slight means that most trees withstand the wind; moderate means that some trees are expected to blow down during excessive wetness and high wind; severe means that many trees are expected to blow down during periods when the soil is wet and winds are moderate or high.

Wildlife

The welfare of a wildlife species depends largely on the amount and distribution of food, shelter, and water (*1*). If any of these elements are missing, inadequate, or inaccessible, the species is absent or scarce. The kinds of wildlife that live in a given area and the number of each kind are closely related to land use, to the resulting kinds and patterns of vegetation, and to the supply and distribution of water. These, in turn, are generally related to the kinds of soils.

Habitat for wildlife normally can be created or improved by planting suitable vegetation, by properly managing the existing plant cover, by fostering the natural establishment of desirable plants, or by using a combination of these measures.

Table 3 rates the soils of Highland County according to their suitability for six elements of wildlife habitat and for three classes of wildlife. The suitability ratings can be used as an aid in:

1. Planning the broad use of parks, refuges, nature study areas, and other recreational developments for wildlife.
2. Selecting the better soils for creating, improving, or maintaining specific kinds of wildlife habitat elements.
3. Determining the relative intensity of management needed for individual habitat elements.
4. Eliminating sites that would be difficult or not feasible to manage for specific kinds of wildlife.
5. Determining areas that are suitable for acquisition for use by wildlife.

In table 3, the ratings indicating relative suitability for six elements of wildlife habitat and for three classes, or groups, of wildlife, are good, fair, poor, and very poor. Not considered in the ratings are present land use including the presence of artificial drainage, the location of a soil in relation to other soils, and the mobility of wildlife. Areas that are artificially drained are seldom used for development of wildlife habitat.

The elements of wildlife habitat are discussed in the following paragraphs.

Each soil is rated in table 3 according to its suitability for various kinds of plants and other elements that make up wildlife habitat.

Grain and seed crops.—Among these crops are corn, sorghum, wheat, barley, oats, millet, buckwheat, cowpeas, other seed producing annuals, and other plants commonly grown for grain or for seed. The major soil properties affecting this habitat element are effective rooting depth, available water capacity, natural drainage, slope, surface stoniness, hazard of flooding, and texture of the surface layer.

Grasses and legumes.—Making up this group are domestic perennial grasses and herbaceous legumes that are established by planting and furnish wildlife cover and food. Among the plants are bluegrass, fescue, brome, timothy, orchardgrass, reed canarygrass, clover, and alfalfa. The major soil properties affecting this habitat element are effective rooting depth, available water

interpretations—Continued

Hazards and limitations that affect management—Con.			Trees to favor in existing stands	Suitable trees for planting
Plant competition		Windthrow hazard		
Conifers	Hardwoods			
Slight	Slight	Moderate	White oak, chestnut oak, shortleaf pine, Virginia pine.	Eastern redcedar, shortleaf pine, Virginia pine.
Moderate	Slight	Moderate	Sycamore, sweetgum, cottonwood, red maple.	Sycamore, sweetgum, cottonwood, red maple.
Slight	Slight	Slight	White oak, chestnut oak, shortleaf pine, Virginia pine.	Shortleaf pine, Virginia pine.
Slight	Slight	Slight	Shortleaf pine, Virginia pine	Shortleaf pine, Virginia pine.

capacity, natural drainage, slopes, surface stoniness, hazard of flooding, and texture of the surface layer.

Wild herbaceous plants.—In this group are native or introduced perennial grasses and weeds that generally are established naturally. They include bluestem, quackgrass, panicgrass, goldenrod, wild carrot, nightshade, and dandelion. They provide food and cover principally to upland forms of wildlife. The major soil properties affecting this habitat element are effective rooting depth, available water capacity, natural drainage, surface stoniness, hazard of flooding or ponding, and texture of the surface layer.

Hardwood trees.—These plants are nonconiferous trees, shrubs, and woody vines that produce nuts or other fruits, buds, catkins, twigs, or foliage that wildlife eat. They are generally established naturally, but may be planted. Among the native kinds are oak, cherry, maple, poplar, apple, hawthorn, dogwood, persimmon, sumac, sassafras, hazelnut, black walnut, hickory, sweetgum, bayberry, blueberry, huckleberry, blackhaw, virburnum, grape, and briers. The major soil properties affecting this habitat element are effective rooting depth, available water capacity, and natural drainage.

Also in this group are several varieties of fruiting shrubs that are raised commercially for planting. Autumnolive, Amur honeysuckle, Tatarian honeysuckle, crabapple, multiflora rose, highbush cranberry, and silky dogwood are some of the shrubs that generally are available and can be planted on soils that are rated well suited. Hardwoods that are not available commercially can commonly be transplanted successfully.

Wetland plants.—Making up this group are wild, herbaceous, annual and perennial plants that grow on moist to wet sites exclusive of submerged or floating aquatics. They produce food and cover extensively used mainly by wetland forms of wildlife. They include smartweed, wild millet, bulrush, sedges, barnyardgrass, pondweed, duckweed, duckmillet, arrowarum, pickerelweed, waterwillow, wetland grasses, wildrice, and cattails. The major soil properties affecting this habitat element are natural drainage, surface stoniness, slope, and texture of the surface layer.

Shallow water areas.—These are areas of surface water with average depth of less than 5 feet, useful to wildlife. They may be natural wet areas or those created by dams or levees or by water-control devices in marshes or streams. Examples are muskrat marshes, waterfowl feeding areas, wildlife water developments, wildlife ponds, and beaver ponding. The major soil properties affecting this habitat element are depth to bedrock, natural drainage, slope, permeability, and surface stoniness or rockiness.

Table 3 rates the soils according to their suitability for three classes of wildlife in the county—openland, woodland, and wetland wildlife.

Openland wildlife.—Examples of openland wildlife are quail, pheasant, meadowlark, field sparrow, dove, cottontail rabbit, red fox, and woodchuck. These birds and mammals normally make their home in areas of cropland, pasture, meadow, and lawns in areas overgrown with grasses, herbs, and shrubs.

Woodland wildlife.—Among the birds and mammals that prefer woodland are woodcock, thrush, vireo, scarlet tanager, gray and fox squirrels, gray fox, white-tailed deer, raccoon, and opossum. They obtain food and cover in stands of hardwoods, coniferous trees, shrubs, or a mixture of these plants.

Wetland wildlife.—Ducks, geese, rails, herons, shore birds, mink, and muskrat are familiar examples of birds and mammals that normally make their home in wet areas, such as ponds, marshes, and swamps.

Each rating under "Kinds of wildlife" in table 3 is based on the ratings listed for the habitat elements in the first part of the table. For openland wildlife the rating is based on the ratings shown for grain and seed crops, grasses and legumes, wild herbaceous plants, and hardwood trees. The rating for woodland wildlife is based on the ratings listed for grasses and legumes, wild herbaceous plants, and hardwood trees. For wetland wildlife the rating is based on the ratings shown for wetland plants and shallow water areas.

TABLE 3.—*Suitability of the soils for elements*

[Avonburg-Urban land complex (AxA), Boston-Urban land complexes (BoB and BoC), Celina-Urban land complex (CfB), Crosby-Urban (OdB), and Rossmoyne-Urban land

Soil series and map symbols	Wildlife habitat elements		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants
Algiers: Ag	Fair	Good	Good
Atlas:			
AtB, AtB2	Fair	Good	Good
AtC2, AtC3	Fair	Good	Good
Avonburg:			
AvA	Fair	Good	Good
AvB	Fair	Good	Good
Beasley:			
BeC2	Fair	Good	Good
BeD2	Poor	Fair	Good
Berks:			
BhD.			
Berks and Muskingum parts	Fair	Good	Good
Neotoma part	Fair	Good	Good
BgF, BhF.			
Berks and Muskingum parts	Very poor	Fair	Good
Neotoma part of BhF	Very poor	Fair	Good
BgG, BhG.			
Berks and Muskingum parts	Very poor	Poor	Good
Neotoma part of BhG	Very poor	Poor	Good
Blanchester: Bk	Poor	Fair	Fair
Boston:			
BmC2, BmC3	Fair	Good	Good
BmD2, BmD3, BmE2	Poor	Fair	Good
BnB, BnB2	Good	Good	Good
Bratton:			
BpB, BpB2	Fair	Good	Good
BpC2	Fair	Good	Good
BpD2, BrD3	Poor	Fair	Good
Brookston: Bs, Bt	Fair	Poor	Poor
Cana:			
CaB	Good	Good	Good
CaC2	Fair	Good	Good
CaD2	Poor	Fair	Good
CaF	Very poor	Fair	Good
Casco:			
CcD3	Poor	Fair	Good
CcF2	Very poor	Fair	Good
Celina:			
CeB	Good	Good	Good
CgA	Good	Good	Good
CgB	Good	Good	Good
Cincinnati:			
ChB	Good	Good	Good
ChC2	Fair	Good	Good
ChD2	Poor	Fair	Good
Clermont: Cm	Poor	Fair	Fair

of wildlife habitat and kinds of wildlife

land complex (CuA), Haubstadt-Urban land complexes (HcB and HcC), Miamian-Urban land complex (MsB), Ockley-Urban complex complex (RtB) are not rated in this table]

Wildlife habitat elements—Continued			Kinds of wildlife		
Hardwood trees	Wetland plants	Shallow water areas	Openland	Woodland	Wetland
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Fair	Very poor	Very poor	Good	Fair	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Fair	Very poor	Very poor	Fair	Fair	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Fair	Very poor	Very poor	Poor	Fair	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor.
Fair	Good	Good	Fair	Fair	Good.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Poor	Good	Fair	Poor	Poor	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Fair	Very poor	Very poor	Fair	Fair	Very poor.
Fair	Very poor	Very poor	Poor	Fair	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Poor	Good	Good	Poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Fair	Good	Good	Fair	Fair	Good.

TABLE 3.—*Suitability of the soils for elements*

Soil series and map symbols	Wildlife habitat elements		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants
Colyer:			
CoD2.			
Colyer part	Poor	Poor	Fair
Trappist part	Poor	Fair	Good
CoF.			
Colyer part	Very poor	Poor	Fair
Trappist part	Very poor	Fair	Good
CoG.			
Colyer part	Very poor	Poor	Fair
Trappist part	Very poor	Poor	Good
Crosby:			
CrA	Fair	Good	Good
CsA	Fair	Good	Good
CsB	Fair	Good	Good
Dana:			
DaA	Good	Good	Good
DaB	Good	Good	Good
Dubois:			
DuA	Fair	Good	Good
DuB	Fair	Good	Good
Edenton:			
EbC2	Fair	Good	Good
EbD2	Poor	Fair	Good
EbF2	Very poor	Fair	Good
Eel: Ee	Fair	Good	Good
Fitchville:			
FcA	Fair	Good	Good
FcB	Fair	Good	Good
Fox:			
FlC2, FoC3	Fair	Good	Good
FlD2	Poor	Fair	Good
FnA, FnB	Good	Good	Good
Gasconade: GaC, GaD2, GbF2, GbG	Poor	Poor	Poor
Genesee: Gn	Fair	Good	Good
Guernsey:			
GuB	Good	Good	Good
GuC, GvC3	Fair	Good	Good
GxD3	Poor	Fair	Good
Haubstadt:			
HbA	Good	Good	Good
HbB	Good	Good	Good
HbC2, HbC3	Fair	Good	Good
HbD2, HbD3	Poor	Fair	Good
Hennepin:			
HeF2	Very poor	Fair	Good
HeG2	Very poor	Poor	Good
HfE3	Poor	Fair	Good
Hickory:			
HkC2, HyC3	Fair	Good	Good
HkD2, HyD3, HkE2, HyE3	Poor	Fair	Good
HkF2	Very poor	Fair	Good
Jessup: JeD	Poor	Fair	Good
Johnsburg: JoC	Fair	Good	Good

of wildlife habitat and kinds of wildlife—Continued

Wildlife habitat elements—Continued			Kinds of wildlife		
Hardwood trees	Wetland plants	Shallow water areas	Openland	Woodland	Wetland
Poor	Very poor	Very poor	Poor	Poor	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Poor	Very poor	Very poor	Poor	Poor	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Poor	Very poor	Very poor	Poor	Poor	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor.
Good	Fair	Fair	Good	Good	Fair.
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Poor	Good	Good	Poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Poor	Good	Good	Poor.
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Poor	Very poor	Very poor	Poor	Poor	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Poor	Good	Good	Poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.

TABLE 3.—*Suitability of the soils for elements*

Soil series and map symbols	Wildlife habitat elements		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants
Kendallville:			
KeB	Good	Good	Good
KeC2	Good	Good	Good
KeD2, KfD3	Poor	Fair	Good
Lawshe:			
LhB	Good	Good	Good
LhC2	Fair	Good	Good
LhD2, LlD3	Poor	Fair	Good
Loudon:			
LoB, LoB2	Good	Good	Good
LoC2	Fair	Good	Good
LoD2	Poor	Fair	Good
LpE2	Poor	Fair	Good
Markland:			
MdB	Good	Good	Good
MdC2	Fair	Good	Good
MdD2	Poor	Fair	Good
McGary: MgB	Fair	Good	Good
Miamian:			
MlB, MlB2	Good	Good	Good
MlC2, MmC3	Fair	Good	Good
MlD2, MlE	Poor	Fair	Good
MrB, MrB2	Good	Good	Good
MrC2	Fair	Good	Good
Millsdale: Mt	Very poor	Poor	Poor
Milton:			
MuB, MuB2	Fair	Good	Good
MuC2, MwC3	Fair	Good	Good
MuD2	Poor	Fair	Good
Montgomery: My	Fair	Poor	Poor
Negley:			
NdC, NfC3	Fair	Good	Good
NdD, NdE, NfD3	Poor	Fair	Good
NdF	Very poor	Fair	Good
NeB	Good	Good	Good
NgF	Very poor	Fair	Good
Nicholson:			
NnB, NnB2	Good	Good	Good
NnC2	Fair	Good	Good
Ockley:			
OcA, OcB	Good	Good	Good
OcC2	Fair	Good	Good
Opequon:			
OpD2, OpE2	Poor	Poor	Fair
OsF2, OsG	Very poor	Poor	Fair
OtD3	Poor	Poor	Fair
Otwell:			
OwB	Good	Good	Good
OwC2	Fair	Good	Good
OwD2, OwE2	Poor	Fair	Good
OwF	Very poor	Fair	Good

of wildlife habitat and kinds of wildlife—Continued

Wildlife habitat elements—Continued			Kinds of wildlife		
Hardwood trees	Wetland plants	Shallow water areas	Openland	Woodland	Wetland
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Poor	Good	Fair	Poor	Poor	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Poor	Very poor	Very poor	Poor	Poor	Very poor.
Poor	Very poor	Very poor	Poor	Poor	Very poor.
Poor	Very poor	Very poor	Poor	Poor	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.

TABLE 3.—*Suitability of the soils for elements*

Soil series and map symbols	Wildlife habitat elements		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants
Patton: Pa, Pb	Fair	Poor	Poor
Peoga: Pe	Poor	Fair	Fair
Philo: Pn	Fair	Good	Good
Ross: Rn	Good	Good	Good
Rossmoyne:			
RpA	Good	Good	Good
RpB, RpB2	Good	Good	Good
RsC3, RpC2	Fair	Good	Good
RpD2	Poor	Fair	Good
Russell: RuB	Good	Good	Good
Sardinia:			
SaA	Good	Good	Good
SaB	Good	Good	Good
SaC2	Fair	Good	Good
Shoals: Sh	Poor	Fair	Fair
Sleeth: SlA	Fair	Good	Good
Sloan: Sn	Poor	Poor	Poor
Stonelick: St	Fair	Good	Good
Thackery:			
ThA	Good	Good	Good
ThB	Good	Good	Good
Trappist:			
TrE	Poor	Fair	Good
TsB.			
Trappist part of TsB	Fair	Good	Good
Muse part of TsB	Good	Good	Good
TsC2	Fair	Good	Good
TsD2	Poor	Fair	Good
Tuscarawas:			
TuD	Poor	Fair	Good
TuF	Very poor	Fair	Good
Warsaw: WaA	Good	Good	Good
Wea: WeA, WeB	Good	Good	Good
Wellston:			
WlC	Fair	Good	Good
WlD	Poor	Fair	Good
Westland: Ws, Wt	Fair	Poor	Poor
Williamsburg:			
WvA, WvB	Good	Good	Good
WvC	Fair	Good	Good
Xenia: XeB	Good	Good	Good

of wildlife habitat and kinds of wildlife—Continued

Wildlife habitat elements—Continued			Kinds of wildlife		
Hardwood trees	Wetland plants	Shallow water areas	Openland	Woodland	Wetland
Poor	Good	Fair	Poor	Poor	Fair.
Fair	Good	Good	Fair	Fair	Good.
Good	Poor	Poor	Good	Good	Poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Poor	Good	Good	Poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Poor	Good	Good	Poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Fair	Fair	Fair	Good	Fair.
Good	Fair	Very poor	Good	Good	Poor.
Poor	Good	Fair	Poor	Poor	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Poor	Good	Good	Poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Poor	Good	Fair	Poor	Poor	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.

Engineering Uses of the Soils[4]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, drainage, shrink-swell potential, grain size, plasticity, and soil reaction. Also important are depth to the water table, depth to bedrock, and slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built to help predict the performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented mainly in tables. Table 4 shows the results of engineering laboratory tests on soil samples, table 5 shows several estimated soil properties significant in engineering, and table 6 shows interpretations for various engineering uses.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in the tables, and it also can be used to make other useful maps.

This information, however, does not eliminate need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths of more than 6 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning to soil scientists. The Glossary defines many of these terms commonly used in soil science.

[4] KYLE L. MORAN, assistant State conservation engineer, and CLIFFORD B. VAN VLIET, civil engineer, Soil Conservation Service, reviewed this section.

Engineering soil classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*3*) used by the SCS engineers, Department of Defense, and others, and the system (*2*) adopted by the American Association of State Highway and Transportation Officials (AASHTO).

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt.

The AASHTO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1, are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHTO classification for tested soils, with group index numbers in parentheses, is shown on table 4; the estimated classification, without group index numbers, is given in table 5 for all soils mapped in the survey area.

Engineering test data

Samples of 15 Highland County soils were tested according to standard AASHTO procedures to help evaluate the soils for engineering purposes. All of the soils that were sampled and tested are of modal profiles that are described as representative of the series in the section "Descriptions of the Soils." Only selected layers of each soil were sampled. The results of these tests are shown in table 4.

Table 4 gives moisture-density data for the tested soils. If a soil material is compacted at increasing moisture content, assuming that the compaction effort remains constant, the density of the compacted material will increase until the *optimum moisture content* is reached. After that, the density decreases as the moisture content increases. The highest dry density obtained in the compaction test is termed *maximum dry density*. Moisture-density data are important in earthwork, for as a rule, maximum stability is obtained if the soil is compacted to the maximum dry density when it is at approximately the optimum moisture content.

The mechanical analysis or grain-size analysis was made by using a combination of the sieve and hydrometer methods. Percentages of clay obtained by the hydrometer method should not be used in naming the textural class for soil classification.

Tests for plastic limit and liquid limit measure the effect of water on the consistence of the soil material. As the moisture content of a soil increases from a very dry state, the material changes from semisolid to plastic. As the

moisture is further increased, the material changes from plastic to liquid. The plastic limit is the moisture content at which the soil material passes from semisolid to plastic; and the liquid limit, from plastic to liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which the soil material is in a plastic condition. Some silty and sandy soils are nonplastic. They do not become plastic at any moisture content.

The engineering soil classifications shown in the engineering test data table are based on data obtained by grain-size analysis and by tests to determine liquid limit and plastic limit.

Soil properties significant in engineering

Several estimated soil properties significant in engineering are given in table 5. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 5.

Depth to seasonal high water table is distance from the surface of the soil to the highest level that ground water reaches in the soil in most years.

Depth to bedrock is distance from the surface of the soil to the upper surface or the rock layer.

Soil texture is described in table 5 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, as for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used are defined in the Glossary of this soil survey.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 5 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH values. The pH value and terms used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Corrosivity, as used in table 5, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. Rate of corrosion of uncoated steel is related to soil properties such as drainage, texture, total acidity, and electrical conductivity of the soil material. Ratings of soils for corrosivity for concrete are based mainly on soil texture and acidity. Installations that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. A corrosivity rating of *low* means that there is a low probability of soil-induced corrosion damage. A rating of *high* means that there is a high probability of damage, so that protective measures for steel and more resistant concrete should be used to avoid or minimize damage.

Engineering interpretations of the soils

The estimated interpretations in table 6 are based on the engineering properties of soils shown in table 5, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of Highland County. In table 6, ratings are used to summarize limitation or suitability of the soils for all listed purposes other than for highway location, reservoir areas, embankments, drainage of crops and pasture, irrigation, terraces or diversions, and grassed waterways. For these particular uses, table 6 lists those soil features not to be overlooked in planning installation and maintenance.

Winter grading is affected chiefly by soil features that affect moving, mixing, and compacting soils used for road building when temperatures are below freezing.

Soils most susceptible to damaging frost action are silt loam and fine sandy loam soils that are wet or saturated most of the winter. The most susceptible soils are rated high.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for preparing a seedbed; natural fertility of the material, or its response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability, but also considered in the ratings is damage that can result at the area from which topsoil is taken.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 6 provide guidance about where to look for probable sources. A soil rated as a *good* or fair source of sand or gravel generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials, and neither do they indicate quality of the deposit.

Road fill is soil material used in embankments for roads. The suitability ratings reflect (1) the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and (2) the relative ease of excavating the material at borrow areas.

Soil properties that most affect highway and road location are load supporting capacity, stability of the subgrade,

TABLE 4.—*Engineering*

[Tests performed by the Ohio Department of Highways in accordance with standard

Soil name and location	Parent material	Report No.	Depth	Moisture density data [1]	
				Maximum dry density	Optimum moisture
			Inches	*Lb per cu ft*	*Percent*
Atlas silt loam:					
In a cultivated field 5 miles west of Hillsboro, ¼ mile south of U.S. Highway 50, ⅛ mile east of Kessler Road, and 125 feet north of stream; in Union Township (Modal).	Glacial till (Illinoian age).	14077	0–7	110	17
		14078	12–30	102	20
		14079	67–90	119	13
Avonburg silt loam:					
In a cultivated field 1⅛ miles west-northwest of Mowrystown on State Route 321, 1⅛ miles north of the intersection of Stringtown and Marconette Roads, 50 yards east-northeast of Stringtown Road; in White Oak Township (Modal).	Loess capped glacial till (Illinoian age).	14084	0–9	107	18
		14085	31–39	100	21
		14086	39–55	102	20
		14087	99–124	119	13
Boston silt loam:					
In a cultivated field 2¼ miles east of Hillsboro on U.S. Highway 50, ⅝ mile south-southeast on Haggerty Road, 300 yards west of Haggerty Road, and 45 yards south of woods; in Liberty Township (Modal).	Loess capped glacial till (Illinoian age) over limestone residuum.	60452	12–18	107	18
		60453	23–32	112	16
		60454	32–53	83	31
Cincinnati silt loam:					
4½ miles south-southwest of Hillsboro, 0.7 mile south of Griffith-Swisshelm Road intersection, ¼ mile north of Warlamount Road and 125 yards east of Swisshelm Road; in New Market Township.	Loess capped glacial till (Illinoian age).	61093	16–28	110	17
		61094	35–45	112	16
		61095	58–90	110	17
		61096	90–115	127	10
Clermont silt loam:					
In a cultivated field 6 miles west of Hillsboro, ¼ mile west of U.S. Highway 50 and Kessler Road intersection, 200 feet south of U.S. Highway 50; in Union Township.	Loess capped glacial till (Illinoian age).	14080	0–13	105	19
		14081	17–25	102	20
		14082	25–37	102	20
		14083	100–116	119	13
Fitchville silt loam:					
In a cultivated field 2¾ miles northwest of Hillsboro, ¼ mile north of the State Route 138 and Selph Road intersection, 330 yards west of Selph Road and 350 yards north of Clear-creek; in Liberty Township.	Slack water deposits (Wisconsin age).	61088	29–37	107	18
		61089	90–106	134	8
Haubstadt silt loam:					
In a cultivated field 1¼ miles north of Marshall, ¾ mile west of Blue Ribbon and Chestnut Road intersection, 266 yards North of Chestnut Road and 133 yards south of Rocky Fork Lake; in Marshall Township.	Silt capped outwash (Illinoian age).	36062	10–18	115	15
		36063	28–53	115	15
		36064	73–110	117	14
Loudon silt loam:					
In a cultivated field 4 miles west of Hillsboro on U.S. Highway 50, 330 yards south of Hoagland on Mad River Road, 220 yards west of Mad River Road; in New Market Township.	Loess capped glacial till (Illinoian age) over shale.	61090	26–38	102	20
		61091	38–45	105	19
		61092	81–100	117	14

See footnotes at end of table.

test data

procedures of the American Association of State Highway and Transportation Officials (*2*)]

Mechanical analysis [2]						Liquid limit	Plasticity index	Classification	
Percentage passing sieve—					Percentage smaller than 0.005 mm			AASHTO [3]	Unified [4]
3-inch	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)					
						Pct			
100	100	100	98	85	37	26	6	A-4(8)	CL-ML
100	100	100	98	87	59	41	19	A-7-6(12)	CL
100	100	100	89	68	36	25	6	A-4(7)	CL-ML
100	100	100	97	85	31	31	6	A-4(8)	ML
100	100	100	98	93	53	41	18	A-7-6(11)	CL
100	100	100	98	87	56	45	21	A-7-6(13)	CL
100	87	80	72	59	31	28	11	A-6(5)	CL
100	100	100	100	99	47	41	19	A-7-6(12)	CL
100	99	94	89	80	48	37	12	A-6(9)	CL-ML
100	100	100	99	96	85	70	30	A-7-5(20)	MH
100	100	100	99	93	43	36	15	A-6(10)	CL
100	100	97	93	76	41	32	14	A-6(10)	CL
100	96	93	89	74	45	41	19	A-7-6(12)	CL
100	93	86	77	55	25	22	6	A-4(4)	CL-ML
100	98	89	86	78	32	32	11	A-6(9)	CL
100	100	99	97	92	50	37	16	A-6(10)	CL
100	100	100	97	91	56	36	14	A-6(10)	CL
100	96	84	75	55	29	26	8	A-4(4)	CL
100	99	97	92	85	44	39	15	A-6(10)	CL-ML
100	53	39	19	12	0	[5] NP	[5] NP	A-1-a	GM
100	95	78	73	54	25	27	8	A-4(4)	CL
100	100	98	93	68	42	29	12	A-6(7)	CL
100	99	86	81	61	56	34	15	A-6(7)	CL
100	97	92	88	79	64	61	32	A-7-6(20)	CH-MH
100	100	100	100	99	74	59	32	A-7-6(20)	CH
100	100	98	97	97	56	46	22	A-7-6(14)	CL

TABLE 4.—*Engineering*

Soil name and location	Parent material	Report No.	Depth	Moisture density data [1]	
				Maximum dry density	Optimum moisture
			Inches	*Lb per cu ft*	*Percent*
Negley loam: In a cultivated field 2 miles south of Hillsboro, 225 feet west of State Route 247, ⅛ mile south of Rocky Fork Creek; in Liberty Township.	Glacial outwash (Illinoian age).	61097 61098	24–42 126–156	112 130	16 10
Nicholson silt loam: In a cultivated field ¼ mile south of Elmville on Elmville Road, then 1⅝ miles southwest on and 140 yards west of Walnut Shade Road; in Brush Creek Township.	Loess capped limestone residuum.	60449 60450 60451	14–24 24–34 50–67	105 112 97	19 16 23
Opequon silt loam: In a cultivated field 2¼ miles west of Sinking Springs, 330 yards south of Sinking Springs and Cedar Chapel Road intersection and 330 yards south of Cedar Chapel Church, 40 feet east of Cedar Chapel Road; in Brush Creek Township.	Residual limestone	36065 36066	8–15 15–19	88 105	30 19
Rossmoyne silt loam: In a cultivated field 8 miles south of Hillsboro, 450 miles west of intersection of McAffee and Concord Roads, 50 yards north of McAffee Road; in Concord Township.	Loess capped glacial till (Illinoian age).	14088 14098 14090 14091	0–8 17–23 23–56 81–97	102 105 112 117	20 19 16 14
Russell silt loam: In a cultivated field 1⅛ miles east of Boston on U.S. Highway 50; 330 yards south of U.S. Highway 50 on North Beach Road, 300 feet west of North Beach Road; in Paint Township.	Loess capped glacial till (Wisconsin age).	60447 60448	26–44 61–82	112 122	16 12
Sardinia silt loam: In a cultivated field 3 miles northeast of Hillsboro, ¼ mile north of the intersection of State Highway 138 and Selph Road, 65 yards west of Selph Road; in Liberty Township.	Silty alluvium over glacial outwash (Wisconsin age).	60444 60445 60446	16–32 32–55 71–85	107 110 126	18 17 10
Williamsburg silt loam: In a cultivated field 3¾ miles east of Hillsboro on U.S. Highway 50, 0.6 mile north of Petersburg Road, and 300 yards north of the intersection of Petersburg Road and Carroll Lane; in Liberty Township.	Silty alluvium over glacial outwash (Wisconsin age).	61099 61100 61101	17–30 42–55 68–80	107 119 117	18 13 14

[1] Based on AASHTO Designation T 99 (*2*).

[2] Mechanical analyses according to AASHTO Designation T 88 (*2*). Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method,

test data—Continued

Mechanical analysis [2]						Liquid limit	Plasticity index	Classification	
Percentage passing sieve—					Percentage smaller than 0.005 mm			AASHTO [3]	Unified [4]
3-inch	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)					
						Pct			
100	83	77	59	45	28	37	12	A-6(3)	SC
100	86	77	25	8	0	NP	NP	A-1-b	SM-SC
100	100	99	96	94	45	40	16	A-6(10)	CL-ML
100	99	95	90	87	44	39	16	A-6(10)	CL
100	99	94	92	90	74	57	22	A-7-5(16)	MH
100	94	75	75	74	51	59	27	A-7-6(18)	CH-MH
100	99	78	76	53	34	34	12	A-6(4)	CL-ML
100	100	100	96	89	34	30	8	A-4(8)	CL-ML
100	99	96	94	84	45	34	12	A-6(9)	CL-ML
100	99	97	94	71	43	29	11	A-6(8)	CL
100	97	86	79	64	36	32	13	A-6(7)	CL
100	100	97	94	81	41	29	11	A-6(16)	CL
100	98	95	90	72	35	24	5	A-4(7)	CL-ML
100	100	100	100	91	43	34	13	A-6(9)	CL
100	100	100	99	86	41	33	12	A-6(9)	CL
100	65	62	49	38	21	35	14	A-6(2)	GC
100	98	96	94	87	39	37	13	A-6(9)	CL-ML
100	95	87	68	35	20	NP	NP	A-2-4	SM
100	94	89	83	60	32	30	13	A-6(6)	CL

and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for naming textural classes for soil.

[3] Based on AASHTO Designation M 145-49 (*2*).

[4] Based on Classification of Soils for Engineering Purposes, ASTM method D 2487-66T (*3*).

[5] NP means nonplastic.

TABLE 5.—*Estimated soil*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in of this table. Absence of data indicates that the soil properties are too variable to be estimated or

Soil series and map symbols	Depth to—		Depth from surface	Dominant USDA texture	Classification		Coarse fraction larger than 3 inches
	Seasonal high water table	Bedrock			Unified	AASHTO	
	Feet	*Feet*	*In*				*Percent*
Algiers: Ag	[2] ½–1½	>5	0–22	Silt loam	ML, CL–ML	A–4	
			22–44	Silt loam, loam	CL	A–6, A–7	
			44–60	Gravelly loam	CL, SC	A–6	
Atlas: AtB, AtB2, AtC2, AtC3	½–1½	>5	0–7	Silt loam	ML, CL	A–4	
			7–24	Clay loam	CL	A–6, A–7	
			24–51	Silty clay	CH, CL	A–7	
			51–77	Clay loam	CL	A–6, A–4	
Avonburg: AvA, AvB, AxA. Urban land part of AxA is too variable to be estimated.	½–1½	>5	0–15	Silt loam	ML, CL	A–4, A–6	
			15–31	Silt loam, silty clay loam.	CL	A–6	
			31–39	Silty clay loam (fragipan).	CL	A–6, A–7	
			39–99	Clay loam, silty clay loam.	CL	A–6, A–7	
Beasley: BeC2, BeD2	1½–3	2½–5	0–5	Silt loam	ML, CL–ML	A–4	
			5–31	Silty clay loam, clay.	CH	A–7	
			31–38	Silty clay	CH	A–7	0–5
			38	Shale.			
*Berks: BgF, BgG, BhD, BhF, BhG. For Muskingum parts, see Muskingum series, and for Neotoma parts of BhD, BhF, and BhG, see Neotoma series.	>3	1½–3	0–6	Channery silt loam.	ML, GM	A–4	0–20
			6–18	Channery silt loam.	GM, SM	A–2, A–4	0–30
			18–27	Very channery silt loam.	GM, GC	A–2, A–1	0–40
			27	Sandstone bedrock.			
Blanchester: Bk	0–1	>5	0–9	Silt loam	ML, CL–ML	A–4	
			9–35	Silty clay loam	CL	A–6	
			35–51	Silty clay loam	CL, CH	A–7, A–6	
			51–70	Clay loam	CL, CH	A–6, A–7	
*Boston: BmC2, BmC3, BmD2, BmD3, BmE2, BnB, BnB2, BoB, BoC. For Bratton parts of BmC2, BmC3, BmD2, BmD3, and BmE2, see Bratton series, and for Grayford parts of BnB and BnB2, see Grayford series. Urban land parts of BoB and BoC are too variable to be estimated.	>5	3½–6	0–12	Silt loam	ML, CL–ML	A–4	
			12–18	Silty clay loam	CL	A–6, A–7	
			18–32	Silty clay loam (fragipan).	CL, ML	A–6, A–7	
			32–58	Clay	CH, MH	A–6, A–7	0–5
			58	Limestone bedrock.			
Bratton: BpB, BpB2, BpC2, BpD2, BrD3.	>3	2–3½	0–16	Silt loam, silty clay loam.	ML, CL	A–4, A–6	
			16–40	Clay	CH	A–7	
			40	Limestone bedrock.			
Brookston: Bs, Bt	0–1	>5	0–18	Silt loam, silty clay loam.	CL, ML	A–6, A–4	
			18–49	Clay, clay loam.	CH, CL	A–7	
			49–65	Clay loam	CL	A–6, A–7	

See footnotes at end of table.

properties significant in engineering

such mapping units may have different properties, and for this reason it is necessary to refer to other series as indicated in the first column that no estimate was made. The symbol > means more than; the symbol < means less than]

Percentage passing sieve—				Permeability	Available water capacity	Reaction [1]	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)					Uncoated steel	Concrete
				In per hr	*In per in of soil*	*pH*			
100	90–100	80–95	70–85	0. 6–2. 0	0. 17–0. 22	6. 1–7. 3	Low	High	Low.
100	90–100	80–95	70–80	0. 6–2. 0	0. 16–0. 20	6. 1–7. 8	Low	High	Low.
85–100	50–85	45–80	40–75	0. 6–2. 0	0. 13–0. 17	6. 6–7. 8	Low	High	Low.
100	90–100	85–100	80–95	0. 6–2. 0	0. 16–0. 19	5. 1–6. 5	Low	High	High.
100	90–100	85–100	80–95	0. 2–0. 6	0. 11–0. 15	4. 5–6. 0	Moderate	High	High.
100	90–100	90–100	85–95	<0. 06	0. 08–0. 12	4. 5–6. 5	High	High	High.
90–100	80–100	70–90	60–80	0. 06–0. 2	0. 08–0. 12	5. 1–7. 8	Moderate	High	Moderate.
100	100	90–100	70–90	0. 6–2. 0	0. 16–0. 19	4. 5–6. 5	Low	High	High.
100	100	90–100	75–90	0. 2–0. 6	0. 12–0. 16	4. 0–5. 5	Low	High	High.
100	90–100	85–100	80–95	<0. 06	0. 07–0. 11	4. 0–5. 5	Moderate	High	High.
90–100	80–100	75–100	70–90	0. 06–0. 2	0. 07–0. 11	4. 5–7. 3	Moderate	High	Moderate.
100	90–100	80–95	70–90	0. 6–2. 0	0. 16–0. 20	4. 5–6. 0	Moderate	Moderate	Moderate.
100	90–100	85–95	75–95	0. 06–0. 6	0. 11–0. 17	4. 5–6. 0	High	High	Moderate.
90–100	85–95	75–90	60–80	0. 06–0. 6	0. 10–0. 14	6. 6–8. 4	High	High	Low.
60–90	50–80	45–70	40–60	0. 6–2. 0	0. 13–0. 17	5. 1–6. 0	Low	Low	Moderate.
55–80	50–70	35–60	30–50	0. 6–2. 0	0. 09–0. 13	4. 5–6. 0	Low	Low	High.
40–70	30–50	20–40	15–35	2. 0–6. 0	0. 07–0. 10	4. 5–5. 0	Low	Low	High.
100	95–100	85–95	75–90	0. 6–2. 0	0. 16–0. 20	5. 1–6. 0	Low	High	Moderate.
95–100	90–100	80–95	70–90	0. 2–0. 6	0. 11–0. 17	5. 1–6. 0	Moderate	High	Moderate.
95–100	85–95	80–90	70–80	0. 06–0. 2	0. 10–0. 14	6. 1–7. 3	Moderate	High	Low.
95–100	85–95	70–85	60–80	0. 06–0. 2	0. 08–0. 12	6. 6–8. 4	Moderate	High	Low.
100	95–100	90–100	80–100	0. 6–2. 0	0. 16–0. 19	4. 5–7. 3	Low	Low	Moderate.
100	95–100	90–100	80–100	0. 6–2. 0	0. 12–0. 16	4. 5–7. 3	Low	Moderate	Moderate.
95–100	85–100	80–95	70–90	0. 2–0. 6	0. 08–0. 12	4. 5–7. 3	Low	Moderate	Moderate.
95–100	90–100	85–100	80–100	0. 2–0. 6	0. 06–0. 10	5. 6–7. 8	Moderate	High	Low.
100	95–100	90–100	80–95	0. 2–2. 0	0. 15–0. 19	5. 6–6. 5	Low	Moderate	Moderate.
100	95–100	90–100	85–95	0. 2–0. 6	0. 06–0. 10	5. 1–7. 8	Moderate	High	Moderate.
100	95–100	85–100	80–95	0. 6–2. 0	0. 18–0. 22	6. 1–7. 8	Moderate	High	Low.
95–100	90–100	80–95	75–90	0. 2–0. 6	0. 12–0. 16	6. 1–7. 8	Moderate	High	Low.
95–100	85–95	75–90	70–85	0. 2–0. 6	0. 10–0. 14	6. 6–8. 4	Moderate	High	Low.

TABLE 5.—*Estimated soil*

Soil series and map symbols	Depth to—		Depth from surface	Dominant USDA texture	Classification		Coarse fraction larger than 3 inches
	Seasonal high water table	Bedrock			Unified	AASHTO	
	Feet	*Feet*	*In*				*Percent*
Cana: CaB, CaC2, CaD2, CaF	1½–3	2½–5	0–13	Silt loam	ML, CL–ML	A–4	
			13–36	Silty clay loam, clay loam.	CL	A–6, A–7	
			36–55	Clay, silty clay.	CH	A–7	0–5
			55	Shale bedrock.			
Casco: CcD3, CcF2	>3	>5	0–6	Gravelly loam	ML	A–4	
			6–20	Gravelly clay loam.	CL, SC	A–6	
			20–60	Stratified sand and gravel, gravelly sandy loam.	SM, GM, SW, GW	A–1	0–10
*Celina: CeB, CfB, CgA, CgB Urban land part of CfB is too variable to be estimated. For Xenia parts of CgA and CgB, see Xenia series.	1–3	>5	0–7	Silt loam	ML, CL–ML	A–4	
			7–39	Silty clay loam, clay, silty clay, clay loam.	CL	A–6, A–7	
			39–60	Loam	CL, CL–ML	A–4, A–6	0–5
Cincinnati: ChB, ChC2, ChD2	>3	>5	0–16	Silt loam	ML, CL	A–4	
			16–35	Silty clay loam, loam.	CL	A–6	
			35–52	Clay loam (fragipan).	CL	A–6	
			52–115	Clay loam, loam.	CL, ML	A–6, A–4, A–7	
Clermont: Cm	½–1	>5	0–13	Silt loam	ML, CL	A–4, A–6	
			13–43	Silty clay loam.	CL	A–6	
			43–100	Clay, silty clay, clay loam.	CL	A–7, A–6	
*Colyer: CoD2, CoF, CoG For Trappist parts, see Trappist series.	>3	1–1½	0–5	Silt loam	ML, CL–ML	A–4, A–6	
			5–19	Shaly silty clay loam.	CL, GC	A–6, A–4, A–2, A–1	0–10
			19	Shale bedrock.			
*Crosby: CrA, CsA, CsB, CuA For Fincastle parts of CsA and CsB, see Fincastle series. Urban land part of CuA is too variable to be estimated.	½–1½	>5	0–9	Silt loam	ML, CL–ML	A–4	
			9–31	Silty clay loam, clay, clay loam.	CL	A–6, A–7	
			31–60	Loam	CL, CL–ML	A–4, A–6	0–5
Dana: DaA, DaB	2–3	>5	0–14	Silt loam	ML, CL–LM	A–4	
			14–48	Silty clay loam, clay loam, silt loam.	CL	A–6, A–7	
			48–60	Loam	ML, CL	A–4, A–6	0–5
Dubois: DuA, DuB	½–1	>5	0–15	Silt loam	ML, CL–ML	A–4	
			15–31	Silty clay loam.	CL	A–6, A–7	
			31–59	Silty clay loam, clay loam (fragipan).	CL	A–6	
			59–131	Clay loam	CL, ML	A–6, A–4	

See footnotes at end of table.

properties significant in engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Reaction [1]	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)					Uncoated steel	Concrete
				In per hr	*In per in of soil*	*pH*			
100	90–100	80–100	70–95	0. 6–2. 0	0. 15–0. 19	5. 6–7. 3	Low	Moderate	Moderate.
95–100	90–100	80–95	70–90	0. 2–0. 6	0. 13–0. 17	4. 5–6. 0	Moderate	High	High.
95–100	70–100	65–95	60–90	0. 06–0. 2	0. 08–0. 12	4. 0–5. 5	Moderate	High	High.
90–100	80–95	65–80	50–70	0. 6–6. 0	0. 14–0. 18	6. 5–7. 3	Low	Low	Low.
70–90	60–75	50–65	40–60	0. 6–6. 0	0. 12–0. 16	6. 1–7. 3	Low	Low	Low.
50–80	40–60	20–35	4–15	>6. 0	0. 03–0. 06	7. 4–7. 8	Low	Low	Low.
100	90–100	80–100	70–95	0. 6–2. 0	0. 17–0. 20	5. 6–7. 3	Low	Moderate	Moderate.
100	90–100	75–95	65–90	0. 2–0. 6	0. 12–0. 16	4. 5–7. 8	Moderate	High	Moderate.
85–100	75–95	60–85	50–75	0. 2–0. 6	0. 06–0. 10	7. 4–7. 8	Low	Moderate	Low.
100	100	90–100	80–95	0. 6–2. 0	0. 16–0. 20	5. 1–6. 5	Low	Low	Moderate.
100	95–100	90–100	70–95	0. 6–2. 0	0. 13–0. 17	4. 5–5. 5	Low	Moderate	High.
95–100	85–100	75–95	65–80	0. 2–0. 6	0. 06–0. 10	4. 5–5. 5	Low	Moderate	High.
90–100	80–100	75–95	55–80	0. 2–2. 0	0. 06–0. 10	5. 1–7. 8	Low	Moderate	Moderate to low.
95–100	85–100	80–95	75–90	0. 2–0. 6	0. 16–0. 17	5. 1–6. 5	Low	High	Moderate.
95–100	95–100	90–100	85–95	0. 06–0. 2	0. 13–0. 17	4. 5–5. 5	Moderate	High	High.
95–100	85–100	75–95	65–80	<0. 06	0. 10–0. 15	4. 5–7. 3	Low	High	Moderate to low.
80–100	75–90	65–90	60–85	0. 6–2. 0	0. 15–0. 18	4. 0–5. 5	Low	Low	High.
70–95	20–85	15–75	12–65	0. 2–0. 6	0. 08–0. 13	4. 0–5. 5	Moderate	Moderate	High.
100	90–100	80–95	70–90	0. 6–2. 0	0. 17–0. 20	5. 6–7. 3	Low	High	Moderate.
95–100	75–95	70–95	65–90	0. 06–0. 2	0. 12–0. 16	5. 6–7. 8	Moderate	High	Moderate.
90–100	70–90	60–80	50–70	0. 2–0. 6	0. 12–0. 16	7. 4–7. 8	Low	High	Low.
100	95–100	85–95	75–95	0. 6–2. 0	0. 18–0. 22	5. 6–6. 5	Low	Low	Moderate.
95–100	85–100	80–95	70–90	0. 6–2. 0	0. 16–0. 19	5. 1–7. 3	Moderate	Moderate	Moderate.
90–100	80–95	70–90	60–80	0. 6–2. 0	0. 15–0. 18	5. 6–7. 8	Low	Low	Moderate.
100	90–100	80–95	70–90	0. 6–2. 0	0. 17–0. 21	5. 6–6. 5	Low	High	Moderate.
100	95–100	80–100	75–95	0. 2–0. 6	0. 13–0. 17	4. 5–6. 0	Moderate	High	High.
100	90–100	80–95	70–90	<0. 06	0. 06–0. 10	4. 5–6. 0	Low	High	High.
80–100	75–100	70–95	60–80	0. 06–0. 6	0. 06–0. 10	6. 6–8. 4	Low	High	Low.

TABLE 5.—*Estimated soil*

Soil series and map symbols	Depth to—		Depth from surface	Dominant USDA texture	Classification		Coarse fraction larger than 3 inches
	Seasonal high water table	Bedrock			Unified	AASHTO	
	Feet	*Feet*	*In*				*Percent*
Edenton: EbC2, EbD2, EbF2	>3	2–3½	0–4	Silt loam	ML, CL	A–4, A–6	
			4–26	Clay loam, clay.	CL, CH	A–6, A–7	
			26–38	Clay, silty clay.	CH	A–7	0–10
			38	Shale and limestone bedrock.			
Eel: Ee	[2] 2–3	>5	0–9	Silt loam	ML	A–4	
			9–29	Silt loam	ML, CL	A–4, A–6	
			29–63	Loam to sandy loam.	ML, SM	A–4, A–2	0–5
Fincastle	½–1½	>5	0–11	Silt loam	ML	A–4	
Mapped only in complexes with Crosby soils.			11–26	Silty clay loam	CL, CL–ML	A–6, A–7	
			26–60	Clay loam, loam.	CL, ML	A–6, A–4	0–5
Fitchville: FcA, FcB	0–1	>5	0–15	Silt loam	ML, CL–ML	A–4	
			15–47	Silt loam, silty clay loam.	CL, CL–ML	A–6, A–4	
			47–68	Clay loam, sandy clay loam.	CL	A–6	
			68–90	Gravelly loam, gravelly clay loam.	ML, GM	A–4	
Fox: FlC2, FlD2, FnA, FnB, FoC3	>3	>5	0–13	Silt loam, loam, clay loam.	ML, CL	A–4, A–6	
			13–39	Clay loam, gravelly clay loam.	CL, CL–ML	A–6	
			39–60	Sand and gravel.	GW, GM, SW, SM	A–1, A–2	0–5
Gasconade:							
GaC, GaD2	>3	½–1½	0–7	Silty clay loam, and flaggy silty clay loam.	CL	A–6, A–7	10–50
GbF2, GbG	>3	½–1½					
			7–15	Flaggy and channery silty clay.	CH	A–7	15–50
			15	Limestone bedrock.			
Genesee: Gn	[2] >3	>5	0–12	Silt loam	ML	A–4	
			12–47	Silt loam	ML, CL–ML	A–4, A–6	
			47–74	Loam to sandy loam.	ML, SM	A–4, A–2	
Grayford	>3	3½–8	0–7	Silt loam	ML, CL–ML	A–4	
Mapped only in complexes with Boston soils.			7–26	Silt loam, silty clay loam.	ML, CL	A–6, A–7	
			26–59	Clay	CH	A–7	0–5
			>59	Limestone bedrock.			
Guernsey: GuB, GuC, GvC3, GxD3	1–3	3½–7	0–11	Silt loam	ML, CL–ML	A–4, A–6	
			11–48	Silty clay loam, silty clay.	CH, CL	A–7, A–6	0–10
			>48	Shale bedrock.			

See footnotes at end of table.

properties significant in engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Reaction [1]	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)					Uncoated steel	Concrete
				In per hr	*In per in of soil*	*pH*			
95–100	90–100	75–95	60–90	0. 6–2. 0	0. 16–0. 19	5. 6–7. 3	Low	Moderate	Moderate.
95–100	80–95	70–95	60–90	0. 2–0. 6	0. 13–0. 17	5. 1–7. 3	Moderate	High	Moderate.
90–100	70–95	65–85	60–80	0. 2–0. 6	0. 10–0. 13	6. 6–7. 8	Moderate	High	Low.
100	95–100	90–100	70–90	0. 6–2. 0	0. 18–0. 22	6. 1–6. 5	Low	Moderate	Low.
100	95–100	85–100	70–90	0. 6–2. 0	0. 16–0. 20	6. 1–8. 4	Low	Moderate	Low.
95–100	90–100	65–80	30–75	0. 6–6. 0	0. 13–0. 17	7. 4–8. 4	Low	Moderate	Low.
100	100	90–100	75–95	0. 6–2. 0	0. 17–0. 21	5. 1–6. 5	Low	High	Low.
100	100	95–100	80–95	0. 2–0. 6	0. 14–0. 18	5. 1–5. 5	Moderate	High	Moderate.
90–100	75–100	70–90	60–80	0. 2–0. 6	0. 13–0. 17	6. 1–7. 8	Moderate	High	Low.
100	100	95–100	80–95	0. 6–2. 0	0. 17–0. 21	6. 6–7. 3	Low	High	Low.
95–100	95–100	90–100	80–95	0. 2–0. 6	0. 15–0. 18	5. 1–6. 5	Moderate	High	Moderate.
90–100	80–100	70–90	55–85	0. 6–2. 0	0. 14–0. 17	6. 1–7. 3	Moderate	High	Low.
65–90	55–75	50–70	40–55	0. 6–6. 0	0. 10–0. 15	6. 6–7. 8	Low	High	Low.
90–100	80–100	75–95	70–85	0. 6–2. 0	0. 12–0. 19	5. 6–6. 5	Low	Low	Moderate.
80–100	60–95	55–80	50–70	0. 6–2. 0	0. 06–0. 14	5. 1–7. 3	Low	Moderate	Moderate.
40–75	30–50	15–45	3–35	>6. 0	0. 02–0. 08	7. 4–7. 8	Low	Low	Low.
80–100	70–95	65–90	60–85	0. 2–0. 6	0. 15–0. 18	6. 6–7. 5	Moderate	Moderate	Low.
75–95	65–90	60–85	55–80	0. 2–0. 6	0. 10–0. 16	6. 6–7. 8	Moderate	High	Low.
100	95–100	85–95	70–90	0. 6–2. 0	0. 17–0. 22	6. 6–7. 5	Low	Low	Low.
95–100	90–100	80–95	70–90	0. 6–2. 0	0. 16–0. 20	6. 1–8. 4	Low	Low	Low.
90–100	85–100	65–85	35–75	0. 6–6. 0	0. 10–0. 14	6. 6–8. 4	Low	Low	Low.
100	100	90–100	75–95	0. 6–2. 0	0. 16–0. 19	5. 6–7. 3	Low	Low	Moderate.
95–100	90–100	80–95	70–95	0. 6–2. 0	0. 14–0. 17	4. 5–6. 5	Moderate	Moderate	Moderate.
90–100	85–100	80–95	70–90	0. 6–2. 0	0. 10–0. 14	5. 1–7. 8	Moderate	High	Moderate.
95–100	90–100	80–95	70–90	0. 6–2. 0	0. 16–0. 19	5. 1–6. 0	Low	Moderate	Moderate.
90–100	85–100	75–95	65–90	0. 06–0. 6	0. 10–0. 15	5. 1–8. 4	Moderate	High	Moderate to low.

TABLE 5.—*Estimsted soil*

Soil series and map symbols	Depth to—		Depth from surface	Dominant USDA texture	Classification		Coarse fraction larger than 3 inches
	Seasonal high water table	Bedrock			Unified	AASHTO	
	Feet	*Feet*	*In*				*Percent*
Haubstadt: HbA, HbB, HbC2, HbC3, HbD2, HbD3, HcB, HcC. Urban land parts of HcB and HcC are too variable to be estimated.	1–3	>5	0–18	Silt loam, loam	ML, CL	A–4	
			18–53	Loam (fragipan).	CL	A–6	
			53–110	Clay loam, gravelly clay loam.	CL	A–6	
*Hennepin: HeF2, HeG2, HfE3. For Miamian parts, see Miamian series.	>3	>5	0–7	Silt loam	ML, CL	A–4, A–6	
			7–11	Clay loam	CL	A–6	
			11–60	Gravelly clay loam, gravelly loam.	CL, ML	A–6, A–4	0–5
Hickory: HkC2, HkD2, HkE2, HkF2, HyC3, HyD3, HyE3.	>3	>5	0–6	Silt loam	ML, CL–ML	A–4	
			6–36	Silty clay loam, clay loam.	CL	A–6, A–7	
			36–60	Clay loam	CL	A–6	0–5
Jessup: JeD	>3	4–10	0–10	Silt loam	ML, CL–ML	A–4	
			10–17	Silty clay loam.	CL	A–6	
			17–38	Silty clay loam, clay.	CH, CL	A–7	
			38–60	Silty clay	CH	A–7	
Johnsburg: JoC	1–3	4–6	0–8	Silt loam	ML, CL–ML	A–4	
			8–28	Silt loam, silty clay loam.	CL, ML	A–6, A–4, A–7	
			28–45	Silty clay loam (fragipan).	CL	A–6, A–7	
			45–60	Clay loam	CL	A–6	0–10
			60	Sandstone bedrock.			
Kendallville: KeB, KeC2, KeD2, KfD3.	>3	>5	0–6	Silt loam, clay loam.	ML, CL	A–4, A–6	
			6–38	Clay loam, gravelly sandy clay loam.	CL, SC	A–6	0–5
			38–60	Clay loam, loam.	ML, CL	A–4, A–6	0–5
Lawshe: LhB, LhC2, LhD2, LID3	>1½	2½–5	0–10	Silty clay loam, silty clay.	CL, MH, CH	A–6, A–7	
			10–44	Silty clay	CH	A–7	0–5
			44	Shale bedrock.			
*Loudon: LoB, LoB2, LoC2, LoD2, LpE2. For Edenton part of LpE2, see Edenton series.	1–3	4–10	0–12	Silt loam	ML, CL–ML	A–4	
			12–26	Silty clay loam.	CL	A–6, A–7	
			26–70	Silty clay, silty clay loam.	CH, CL	A–7	
			70	Soft weathered shale bedrock.			
Markland: MdB, MdC2, MdD2	1–3	>5	0–6	Silt loam	ML, CL–ML	A–4	
			6–61	Silty clay loam, silty loam.	CH, CL	A–7, A–6	

See footnotes at end of table.

properties significant in engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Reaction [1]	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)					Uncoated steel	Concrete
				In per hr	*In per in of soil*	*pH*			
95–100	75–100	70–95	50–85	0. 6–2. 0	0. 17–0. 20	4. 5–6. 5	Low	Moderate	Moderate.
90–100	85–100	80–95	65–80	0. 06–0. 2	0. 10–0. 14	4. 5–6. 0	Moderate	Moderate	High.
80–100	60–90	60–85	55–75	0. 6–2. 0	0. 10–0. 14	4. 5–7. 3	Low	High	High.
95–100	90–100	85–100	70–95	0. 6–2. 0	0. 17–0. 19	6. 1–7. 5	Low	Low	Low.
90–100	80–100	75–90	65–85	0. 6–2. 0	0. 14–0. 17	6. 1–8. 4	Low	Moderate	Low.
80–100	65–90	60–85	55–75	0. 6–2. 0	0. 10–0. 13	7. 4–8. 4	Low	Moderate	Low.
100	95–100	85–100	70–90	0. 6–2. 0	0. 17–0. 19	6. 1–7. 5	Low	Moderate	Low.
95–100	90–100	80–95	65–90	0. 6–2. 0	0. 14–0. 17	4. 5–7. 8	Moderate	High	Moderate.
90–100	85–100	75–90	65–85	0. 6–2. 0	0. 13–0. 15	7. 4–7. 8	Low	High	Low.
100	100	80–100	75–95	0. 6–2. 0	0. 17–0. 19	5. 6–6. 5	Low	Low	Moderate.
100	95–100	85–95	75–90	0. 6–2. 0	0. 14–0. 17	4. 5–6. 0	Low	Moderate	Moderate.
90–100	80–100	75–95	70–90	0. 2–0. 6	0. 13–0. 15	4. 5–6. 0	Moderate	High	Moderate.
90–100	75–95	70–90	65–80	0. 06–0. 2	0. 10–0. 13	6. 6–7. 8	Moderate	High	Low.
100	100	85–100	75–95	0. 6–2. 0	0. 17–0. 20	5. 1–6. 5	Low	High	Moderate.
100	95–100	85–95	75–95	0. 2–0. 6	0. 14–0. 17	4. 5–6. 0	Moderate	High	High.
95–100	90–100	80–95	70–90	<0. 06	0. 06–0. 10	4. 0–5. 0	Low	High	High.
90–100	80–100	75–90	65–85	0. 2–0. 6	0. 06–0. 10	4. 0–5. 0	Low	High	High.
95–100	85–100	80–95	70–90	0. 6–2. 0	0. 17–0. 20	5. 6–6. 5	Low	Low	Moderate.
80–100	65–90	50–80	40 70	0. 2–0. 6	0. 12–0. 16	5. 1–7. 8	Moderate	Moderate	Moderate.
80–100	65–85	60–80	55–75	0. 2–2. 0	0. 12–0. 16	7. 4–7. 8	Low	Moderate	Low.
100	95–100	90–100	80–95	0. 2–0. 6	0. 14–0. 17	6. 6–7. 5	Moderate	High	Low.
95–100	90–100	85–95	80–90	<0. 06	0. 12–0. 15	6. 6–8. 4	High	High	Low.
100	95–100	85–100	80–95	0. 6–2. 0	0. 16–0. 19	5. 1–6. 5	Low	Low	Moderate.
95–100	90–100	85–95	75–95	0. 2–0. 6	0. 13–0. 17	4. 5–6. 5	Moderate	Moderate	Moderate.
95–100	80–100	80–100	75–100	0. 06–0. 2	0. 10–0. 14	5. 1–8. 4	Moderate	High	Moderate to low.
100	95–100	85–100	75–95	0. 6–2. 0	0. 15–0. 19	5. 6–6. 5	Low	Moderate	Moderate.
100	90–100	85–100	80–95	0. 06–0. 2	0. 10–0. 15	5. 1–7. 8	Moderate	High	Moderate to low.

TABLE 5.—*Estimated soil*

Soil series and map symbols	Depth to—		Depth from surface	Dominant USDA texture	Classification		Coarse fraction larger than 3 inches
	Seasonal high water table	Bedrock			Unified	AASHTO	
	Feet	*Feet*	*In*				*Percent*
McGary: MgB	½–1½	>5	0–8	Silt loam	ML, CL	A–6, A–4	
			8–40	Silty clay loam, silty clay.	CH, CL	A–6, A–7	
			40–60	Silty clay, clay.	CH	A–7	
*Miamian: MlB, MlB2, MlC2, MlD2, MlE, MmC3, MrB, MrB2, MrC2, MsB. For Russell parts of MrB, MrB2, and MrC2, see Russell series. Urban land part of MsB is too variable to be estimated.	>3	>5	0–7	Silt loam, clay loam.	ML, CL	A–4, A–6	
			7–30	Clay, clay loam, silty clay loam.	CH, CL	A–7, A–6	
			30–60	Clay loam, loam.	CL	A–6, A–7	0–5
Millsdale: Mt	0–1	2½–3½	0–13	Silty clay loam.	CL, CL–ML	A–6	
			13–32	Silty clay, clay, silty clay loam.	CH, CL	A–7	0–5
			32	Limestone bedrock.			
Milton: MuB, MuB2, MuC2, MuD2, MwC3.	>3	1½–3½	0–12	Silt loam, clay loam.	ML, CL	A–4, A–6	
			12–21	Silty clay loam, clay loam.	CL	A–6, A–7	
			21–33	Clay	CH	A–7	0–10
			33	Limestone bedrock.			
Montgomery: My	0–1	>5	0–16	Silty clay loam	CL, CL–ML	A–6	
			16–60	Silty clay, clay, silty clay loam.	CH, CL	A–7	
Muse	>3	3–6½	0–12	Silt loam	ML, CL–ML	A–4	0–5
Mapped only in complexes with Trappist soils.			12–37	Silty clay, silty clay loam.	CH, CL	A–7, A–6	0–10
			37–52	Shaly silty clay loam.	CL, CH	A–7, A–6	5–25
			52	Black fissile shale bedrock.			
Muskingum	>3	1½–3½	0–6	Channery silt loam.	ML	A–4	5–15
Mapped only in complexes with Berks soils and with Berks and Neotoma soils.			6–25	Channery silt loam, channery loam.	ML, GM	A–4	10–30
			25	Sandstone bedrock.			
*Negley: NdC, NdD, NdE, NdF, NeB, NfC3, NfD3, NgF. For Fox part of NgF, see Fox series.	>3	>5	0–14	Loam, silt loam, clay loam.	ML, CL	A–4, A–6	
			14–33	Loam, gravelly clay loam.	ML, CL, SM, SC	A–4, A–2, A–6	
			33–126	Gravelly sandy clay loam, sandy clay.	GM, SM, SC	A–2, A–4, A–7	0–5
			126–156	Sand and gravel.	GM, GW, SM, SP, SC	A–1, A–2	0–5

See footnotes at end of table.

properties significant in engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Reaction [1]	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)					Uncoated steel	Concrete
				In per hr	*In per in of soil*	*pH*			
100	100	95–100	75–95	0. 6–2. 0	0. 16–0. 19	6. 6–7. 3	Low	High	Low.
100	100	95–100	90–95	0. 06–0. 2	0. 12–0. 16	5. 6–7. 8	Moderate	High	Moderate.
100	95–100	90–100	80–90	<0. 06	0. 10–0. 14	7. 4–7. 8	Moderate	High	Low.
90–100	90–100	85–100	70–90	0. 6–2. 0	0. 16–0. 19	5. 6–7. 3	Low	Moderate	Moderate.
90–100	90–100	80–95	70–90	0. 2–0. 6	0. 11–0. 15	5. 1–7. 3	Moderate	High	Moderate.
90–100	85–100	70–90	60–80	0. 2–0. 6	0. 12–0. 16	6. 6–7. 8	Low	Moderate	Low.
95–100	90–100	85–100	80–95	0. 6–2. 0	0. 18–0. 23	6. 1–7. 3	Moderate	High	Low.
90–100	80–100	80–95	70–95	0. 2–0. 6	0. 11–0. 17	6. 1–8. 4	High	High	Low.
95–100	90–100	85–100	70–95	0. 6–2. 0	0. 17–0. 20	5. 6–7. 3	Low	Low	Moderate.
95–100	85–100	80–100	75–95	0. 2–0. 6	0. 13–0. 17	5. 1–7. 3	Moderate	Moderate	Moderate.
90–100	85–100	80–100	70–95	0. 2–0. 6	0. 10–0. 14	6. 1–7. 8	High	High	Low.
100	100	95–100	80–95	0. 2–0. 6	0. 18–0. 23	6. 1–7. 3	Moderate	High	Low.
100	100	90–100	80–95	<0. 2	0. 12–0. 16	6. 1–7. 8	Moderate	High	Low.
95–100	80–100	75–95	70–90	0. 6–2. 0	0. 16–0. 19	5. 1–6. 5	Low	Low	Moderate.
90–100	85–100	75–95	65–90	0. 06–0. 2	0. 12–0. 16	4. 0–5. 5	Moderate	High	High.
70–90	50–80	50–75	50–70	0. 06–0. 2	0. 09–0. 13	4. 0–5. 5	Moderate	High	High.
80–95	70–90	65–85	60–80	0. 6–2. 0	0. 14–0. 18	5. 1–6. 0	Low	Low	Moderate.
60–90	40–80	40–70	35–65	0. 6–2. 0	0. 10–0. 14	4. 0–5. 0	Low	Low	High.
90–100	85–100	70–90	60–80	0. 6–6. 0	0. 13–0. 17	5. 1–6. 5	Low	Low	Moderate.
85–95	70–90	50–75	30–60	0. 6–6. 0	0. 10 -0. 14	4. 5–6. 0	Low	Low	High.
80–95	65–90	40–70	20–50	0. 6–6. 0	0. 08–0. 12	4. 5–7. 3	Low	Low	High to moderate.
40–90	25–80	15–50	0–35	>6. 0	0. 04–0. 08	7. 4–7. 8	Low	Low	Low.

Table 5.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	Dominant USDA texture	Classification		Coarse fraction larger than 3 inches
	Seasonal high water table	Bedrock			Unified	AASHTO	
	Feet	*Feet*	*In*				*Percent*
Neotoma	>3	3–5	0–13	Channery silt loam.	ML, GM	A–4	5–25
Mapped only in complexes with Berks and Muskingum soils.			13–32	Channery silt loam.	ML, GM	A–4	15–35
			32–60	Very channery loam.	GM, ML	A–2, A–4	30–70
			60	Sandstone bedrock.			
Nicholson: NnB, NnB2, NnC2	1–3	3½–7½	0–8	Silt loam	ML	A–4	
			8–24	Silt loam	ML, CL	A–4, A–6	
			24–42	Silt loam, silty clay loam (fragipan).	CL	A–6	
			42–74	Clay, silty clay.	CH, MH	A–7	
			74	Limestone bedrock.			
Ockley: OcA, OcB, OcC2, OdB	>3	>5	0–9	Silt loam	ML	A–4	
Urban land part of OdB is too variable to be estimated.			9–21	Silty clay loam.	CL, CL–ML	A–6, A–7	
			21–58	Loam, gravelly loam, silty clay loam.	CL, ML	A–6, A–4	
			58–70	Gravelly sandy loam.	SM, GM	A–1, A–2	0–10
Opequon: OpD2, OpE2, OsF2, OsG, OtD3.	>3	1–1½	0–5	Silt loam	ML, CL	A–4, A–6	0–25
			5–19	Clay, silty clay loam.	CH, CL, MH	A–7	5–35
			19	Limestone bedrock.			
Otwell: OwB, OwC2, OwD2, OwE2, OwF.	>3	>5	0–14	Silt loam	ML	A–4	
			14–32	Silt loam, silty clay loam.	CL, ML	A–4, A–6	
			32–55	Silty clay loam, loam (fragipan).	CL, ML	A–6, A–4	
			55–110	Sandy clay loam.	SC, CL	A–6	0–5
Patton: Pa, Pb	0–1	>5	0–16	Silt loam, silty clay loam.	ML, CL	A–4, A–6	
			16–55	Silty clay loam	CL	A–6, A–7	
			55–105	Clay loam	CL	A–6, A–7	
Peoga: Pe	0–1	>5	0–24	Silt loam	ML, CL–ML	A–4, A–6	
			24–72	Silty clay loam, silty clay.	CL	A–7, A–6	
			72–97	Silty clay loam	CL	A–6, A–7	
Philo: Pn	[2] 1–3	>5	0–16	Silt loam	ML	A–4	
			16–36	Loam	ML	A–4	
			36–60	Stratified loam, sandy clay loam, loamy sand.	ML, SC, SM	A–4, A–2, A–6	0–5

See footnotes at end of table.

significant in engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Reaction [1]	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)					Uncoated steel	Concrete
				In per hr	*In per in of soil*	*pH*			
65–85	60–80	50–70	45–65	0. 6–6. 0	0. 14–0. 20	5. 1–6. 5	Low	Low	Moderate.
55–80	50–75	45–70	40–60	0. 6–6. 0	0. 10–0. 16	5. 1–6. 5	Low	Low	Moderate.
40–65	35–60	30–50	25–45	2. 0–6. 0	0. 06–0. 10	4. 5–6. 5	Low	Low	High.
100	100	90–100	70–90	0. 6–2. 0	0. 16–0. 20	4. 5–6. 0	Low	Moderate	High.
100	95–100	90–100	70–95	0. 6–2. 0	0. 14–0. 18	4. 5–6. 0	Low	Moderate	High.
95–100	95–100	85–100	70–95	0. 06–0. 2	0. 08–0. 12	4. 5–6. 5	Low	High	High.
95–100	90–100	80–100	75–95	0. 06–0. 2	0. 06–0. 12	5. 6–7. 8	Moderate	High	Moderate to low.
100	100	80–100	70–90	0. 6–2. 0	0. 16–0. 20	4. 5–6. 0	Low	Low	High.
95–100	95–100	85–100	75–95	0. 6–2. 0	0. 13–0. 17	4. 5–6. 0	Moderate	Moderate	High.
80–100	65–100	60–90	50–80	0. 6–2. 0	0. 11–0. 15	4. 5–7. 8	Low	Low	High.
60–90	30–60	20–50	5–35	>6. 0	0. 02–0. 08	5. 6–7. 8	Low	Low	Moderate to low.
80–100	85–100	80–95	70–90	0. 6–2. 0	0. 16–0. 19	5. 6–7. 8	Low	Moderate	Moderate to low.
85–100	75–95	70–90	50–85	0. 06–2. 0	0. 11–0. 15	5. 6–7. 8	Moderate	High	Moderate to low.
100	90–100	80–95	75–95	0. 6–2. 0	0. 16–0. 20	5. 6–6. 5	Low	Low	Moderate.
100	90–100	80–95	70–95	0. 2–0. 6	0. 13–0. 17	4. 5–6. 0	Moderate	Moderate	High.
90–100	85–100	75–95	65–90	<0. 06	0. 08–0. 12	4. 5–6. 0	Low	Moderate	High.
90–100	80–95	75–90	35–60	0. 2–0. 6	0. 08–0. 12	5. 6–7. 8	Low	Moderate	Moderate to low.
100	100	90–100	75–95	0. 6–2. 0	0. 17–0. 21	5. 6–6. 5	Low	High	Moderate.
100	95–100	90–100	80–95	0. 06–0. 2	0. 15–0. 19	5. 1–6. 5	Moderate	High	Moderate.
95–100	90–100	80–100	65–85	0. 06–0. 6	0. 12–0. 14	5. 6–7. 8	Moderate	High	Moderate.
100	100	80–100	75–95	0. 6–2. 0	0. 16–0. 20	4. 5–6. 5	Low	High	High.
100	95–100	80–100	85–95	0. 06–0. 2	0. 11–0. 15	4. 5–6. 0	Moderate	High	High.
100	95–100	80–100	85–95	0. 06–0. 2	0. 10–0. 14	6. 1–8. 4	Moderate	High	Low.
100	95–100	90–100	70–90	0. 6–2. 0	0. 17–0. 21	5. 1–6. 0	Low	Moderate	Moderate.
90–100	80–100	75–90	60–80	0. 2–2. 0	0. 15–0. 18	4. 5–5. 5	Low	Moderate	High.
85–100	75–100	60–85	25–65	0. 2–2. 0	0. 06–0. 14	4. 5–5. 5	Low	Moderate	High.

TABLE 5.—*Estimated soil*

Soil series and map symbols	Depth to—		Depth from surface	Dominant USDA texture	Classification		Coarse fraction larger than 3 inches
	Seasonal high water table	Bedrock			Unified	AASHTO	
	Feet	*Feet*	*In*				*Percent*
Ross: Rn	[2] >3	>5	0–24	Silt loam	ML, CL–ML	A–4	
			24–55	Loam, silt loam	ML, CL–ML	A–4, A–6	
			55–81	Stratified sand and gravel.	SM, GM	A–2, A–1, A–4	0–5
Rossmoyne: RpA, RpB, RpB2, RpC2, RpD2, RsC3, RtB. Urban land part of RtB is too variable to be estimated.	1–3	>5	0–12	Silt loam	ML, CL–ML	A–4	
			12–23	Silt loam, silty clay loam.	CL, CL–ML	A–6, A–7	
			23–56	Clay loam, loam (fragipan).	CL	A–6	
			56–97	Clay loam, gravelly loam.	CL	A–6	0–5
Russell: RuB	>3	>5	0–11	Silt loam	ML, CL–ML	A–4	
			11–26	Silty clay loam, silt loam.	CL, CL–ML	A–6, A–7	
			26–82	Silt loam, loam, clay loam.	ML, CL	A–6, A–4	0–5
Sardinia: SaA, SaB, SaC2	1–3	>5	0–9	Silt loam	ML	A–4	
			9–71	Silty clay loam, clay loam, silt loam, loam.	CL	A–6, A–7	
			71–85	Gravelly sandy clay loam.	SC, GC, CL	A–2, A–6, A–4	
Shoals: Sh	[2] ½–1½	>5	0–12	Silt loam	ML	A–4	
			12–62	Loam, silt loam, sandy loam.	ML, SM, CL–ML	A–4, A–2	
Sleeth: SlA	½–1½	>5	0–15	Silt loam	ML	A–4	
			15–43	Silty clay loam, silty clay.	CL	A–6, A–7	
			43–60	Gravelly clay, gravelly loam.	CL, GC	A–6, A–7	
			60–63	Sand and gravel.	GW, GM, SM, SP	A–1, A–2	0–10
Sloan: Sn	0–1	>5	0–38	Silt loam	ML	A–4	
			38–60	Sandy loam, loamy sand.	SM	A–2, A–4	
Stonelick: St	[2] >3	>5	0–14	Loam	ML	A–4	
			14–34	Sandy loam, loamy sand.	SM	A–2, A–4	
			34–60	Gravelly sand	SM, SP–SM	A–1, A–2	0–5
Thackery: ThA, ThB	1–3	>5	0–12	Silt loam	ML	A–4	
			12–30	Silty clay loam, clay loam.	CL	A–6, A–7	
			30–50	Gravelly sandy clay loam, gravelly clay loam.	SC, CL, GC	A–6	
			50–62	Sand and gravel.	GW, GM, SM, SP	A–1, A–2	0–5

See footnotes at end of table.

properties significant in engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Reaction [1]	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)					Uncoated steel	Concrete
				In per hr	*In per in of soil*	*pH*			
95–100	90–100	80–95	70–90	0. 6–2. 0	0. 19–0. 23	6. 1–8. 4	Low	Low	Low.
95–100	90–100	75–90	60–85	0. 6–2. 0	0. 14–0. 18	6. 1–8. 4	Low	Low	Low.
50–80	40–70	35–60	12–45	>2. 0	0. 04–0. 08	6. 1–8. 4	Low	Low	Low.
100	95–100	85–100	75–95	0. 6–2. 0	0. 17–0. 21	4. 5–6. 5	Low	Moderate	Moderate.
95–100	95–100	90–100	80–95	0. 6–2. 0	0. 13–0. 17	4. 5–5. 5	Moderate	High	High.
95–100	90–100	80–95	70–80	0. 06–0. 6	0. 09–0. 13	4. 5–5. 5	Low	High	High.
80–100	70–95	65–90	60–80	0. 2–0. 6	0. 09–0. 13	5. 6–7. 8	Low	High	Moderate to low.
100	95–100	85–100	75–95	0. 6–2. 0	0. 07–0. 21	5. 1–6. 0	Low	Low	Moderate.
95–100	90–100	85–100	80–95	0. 6–2. 0	0. 14–0. 18	4. 5–6. 5	Moderate	Moderate	High.
90–100	80–100	75–95	70–85	0. 6–2. 0	0. 13–0. 17	5. 6–7. 8	Low	Moderate	Moderate to low.
95–100	95–100	80–95	70–90	0. 6–2. 0	0. 16–0. 19	5. 1–6. 5	Low	Moderate	Moderate.
85–100	80–100	80–100	60–95	0. 6–2. 0	0. 13–0. 17	4. 5–7. 3	Moderate	High	Moderate to low.
65–95	60–90	45–80	35–65	2. 0–6. 0	0. 10–0. 14	6. 6–7. 8	Low	High	Low.
100	100	80–100	75–95	0. 6–2. 0	0. 17–0. 20	6. 1–7. 3	Low	High	Low.
95–100	90–100	70–95	35–75	0. 6–2. 0	0. 15–0. 19	6. 1–8. 4	Low	High	Low.
95–100	90–100	85–95	70–90	0. 6–2. 0	0. 16–0. 20	5. 1–6. 0	Low	High	Moderate.
90–100	85–100	80–100	75–95	0. 6–2. 0	0. 14–0. 18	5. 1–7. 8	Moderate	High	Moderate to low.
65–85	50–75	45–70	40–65	0. 6–6. 0	0. 11–0. 15	6. 6–8. 4	Moderate	High	Low.
40–70	25–60	15–50	0–35	>6. 0	0. 02–0. 08	6. 6–8. 4	Low	Low	Low.
100	95–100	80–95	70–90	0. 6–2. 0	0. 18–0. 23	6. 1–8. 4	Low	High	Low.
95–100	90–100	50–75	20–40	2. 0–6. 0	0. 08–0. 12	6. 1–8. 4	Low	High	Low.
95–100	95–100	80–95	60–75	2. 0–6. 0	0. 11–0. 15	6. 6–7. 8	Low	Low	Low.
90–100	85–100	50–75	25–40	2. 0–6. 0	0. 07–0. 11	6. 6–8. 4	Low	Low	Low.
75–100	65–95	45–65	5–15	>2. 0	0. 04–0. 08	6. 6–8. 4	Low	Low	Low.
95–100	90–100	85–95	70–90	0. 6–2. 0	0. 16–0–20	5. 1–6. 5	Low	Moderate	Moderate.
90–100	85–100	80–95	70–85	0. 6–2. 0	0. 14–0. 18	5. 1–6. 0	Moderate	High	Moderate.
65–90	55–85	45–75	35–65	2. 0–6. 0	0. 11–0. 15	5. 6–7. 8	Moderate	High	Moderate to low.
40–70	25–65	15–50	0–35	>6. 0	0. 02–0. 08	7. 4–8. 4	Low	Low	Low.

Table 5.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	Dominant USDA texture	Classification		Coarse fraction larger than 3 inches
	Seasonal high water table	Bedrock			Unified	AASHTO	
	Feet	*Feet*	*In*				*Percent*
*Trappist: TrE, TsB, TsC2, TsD2—For Muse parts of TsB, TsC2, and TsD2, see Muse series.	>3	2–3	0–6	Silt loam	ML, CL–ML	A–4	
			6–14	Silty clay loam.	CL, CH	A–6, A–7	
			14–32	Very shaly silty clay loam, shaly silty clay.	GC, CL	A–6, A–7	0–20
			32	Black fissile shale bedrock.			
Tuscarawas: TuD, TuF	>3	3–6	0–15	Channery silt loam.	ML, CL–ML	A–4	0–20
			15–36	Channery clay loam.	CL	A–6, A–7	5–40
			36–60	Silty clay	CL, CH	A–7	0–5
Warsaw: WaA	>3	>5	0–16	Silt loam, loam	ML, CL–ML	A–4	
			16–28	Gravelly clay loam.	CL	A–6, A–7	
			28–60	Sand and gravel.	GW, GM, SM, SP	A–1, A–2	0–5
Wea: WeA, WeB	>3	>5	0–16	Silt loam, loam	ML, CL–ML	A–4	
			16–48	Clay loam, gravelly clay loam.	CL	A–6, A–7	
			48–60	Sand and gravel.	GW, GM, SM, SP	A–1, A–2	0–5
Wellston: WIC, WID	>3	3–6	0–8	Silt loam	ML	A–4	
			8–38	Silty clay loam	CL, ML	A–6, A–4	
			38–44	Channery clay loam.	GC, CL, GM	A–6, A–4	0–10
			44	Sandstone bedrock.			
Westland: Ws, Wt	0–1	>5	0–11	Silt loam, silty clay loam.	ML, CL	A–4, A–6	
			11–48	Sandy clay loam, gravelly sandy loam.	SC, CL	A–6	
			48–62	Sand and gravel.	GW, GM, SM, SP	A–1, A–2	0–5
Williamsburg: WvA, WvB, WvC	>3	>5	0–12	Silt loam	ML	A–4	
			12–23	Silty clay loam, silt loam.	CL, ML	A–6, A–4	
			23–68	Sandy clay loam, sandy loam, loam.	SC, CL, SM	A–6, A–4, A–2	
			68–91	Loam	ML, SM, CL	A–4, A–6	
Xenia: XeB	1–3	>5	0–11	Silt loam	ML, CL–ML	A–4	
			11–28	Silty clay loam.	CL, CL–ML	A–6, A–7	
			28–54	Clay loam	CL	A–6	
			54–65	Loam	ML, CL	A–4, A–6	

[1] The reaction given for the surface layer represents the average pH of the surface layer. In many places, it is high because of limiting practices.

significant in engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Reaction [1]	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)					Uncoated steel	Concrete
				In per hr	*In per in of soil*	*pH*			
95–100	90–100	80–100	70–90	0. 6–2. 0	0. 16–0. 20	4. 5–6. 0	Low	Low	High.
90–100	90–100	80–95	75–90	0. 06 0. 2	0. 13–0. 17	4. 0–5. 5	Moderate	Moderate	High.
50–80	40–70	40–65	35–60	0. 06–0. 2	0. 11–0. 15	4. 0–5. 5	Moderate	Moderate	High.
85–100	75–95	70–90	60–80	0. 6–2. 0	0. 14–0. 18	5. 1–6. 5	Low	Moderate	Moderate.
80–95	70–90	60–80	50–70	0. 6–2. 0	0. 12–0. 16	4. 5–6. 0	Moderate	High	High.
90–100	85–100	80–90	75–85	0. 06–0. 2	0. 10–0. 14	4. 0–5. 0	Moderate	High	High.
90–100	85–100	75–95	60–85	0. 6–2. 0	0. 15–0. 19	5. 1–6. 5	Low	Low	Moderate.
70–95	65–90	60–80	55–70	0. 6–2. 0	0. 11–0. 15	5. 1–7. 3	Moderate	Moderate	Moderate to low.
40–70	25–65	15–50	0–35	>6. 0	0. 02–0. 08	6. 6–7. 8	Low	Low	Low.
90–100	85–100	80–95	65–85	0. 6–2. 0	0. 15–0. 19	5. 6–6. 5	Low	Low	Moderate.
70–95	65–90	60–85	55–75	0. 6–2. 0	0. 11–0. 15	5. 1–7. 3	Moderate	Moderate	Moderate to low.
40–70	25–65	15–50	0 35	>6. 0	0. 02–0. 08	6. 6–7. 8	Low	Low	Low.
95–100	95–100	85–100	70–90	0. 6–2. 0	0. 15 0. 19	5. 1–6. 0	Low	Low	Moderate.
80–100	75–100	70–95	60–90	0. 6–2. 0	0. 12–0. 16	4. 0–6. 0	Low	Moderate	High.
45–75	40–65	35–65	35–60	0. 6–2. 0	0. 10–0. 14	4. 0–5. 0	Low	Moderate	High.
95–100	90–100	80–100	70–95	0. 6–2. 0	0. 18–0. 22	5. 6–7. 3	Low	High	Moderate to low.
80–100	70–95	60–85	40–65	0. 06–2. 0	0. 14–0. 18	6. 6–8. 4	Low	High	Low.
40–70	25–65	15–50	5–20	>6. 0	0. 04–0. 08	7. 4–8. 4	Low	High	Low.
100	95–100	85–100	70–95	0. 6–2. 0	0. 16–0. 19	5. 1–6. 5	Low	Low	Moderate.
95–100	90–100	85–100	75–95	0. 6–2. 0	0. 12–0. 16	4. 5–6. 0	Moderate	Moderate	High.
80–100	70–100	60–85	35–60	0. 6–2. 0	0. 09–0. 13	4. 5–7. 3	Moderate	Moderate	Moderate.
80–100	70–90	60–85	45–75	0. 6–2. 0	0. 09–0. 14	5. 6–7. 8	Low	Low	Moderate.
100	100	90–100	80–95	0. 6–2. 0	0. 17–0. 20	5. 1–6. 5	Low	Moderate	Moderate.
95–100	95–100	90–100	80–95	0. 2–2. 0	0. 13–0. 17	5. 1–6. 0	Moderate	High	Moderate.
90–100	85–100	80–95	65–80	0. 2–0. 6	0. 12–0. 16	5. 1–7. 8	Moderate	High	Moderate to low.
90–100	85–100	80–95	55–75	0. 2–2. 0	0. 12–0. 17	7. 4–7. 8	Low	Moderate	Low.

[2] Subject to flooding.

TABLE 6.—*Interpretations of*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in the first column

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as a source of—		
			Topsoil	Sand and gravel	Road fill
Algiers: Ag	Poor: subject to flooding; seasonal high water table.	High	Good	Unsuited	Fair: low strength; seasonal high water table.
Atlas: AtB, AtB2, AtC2, AtC3	Poor: seasonal high water table; clayey material.	Moderate	Fair: thin layer of suitable material.	Unsuited	Poor: clayey material; high shrink-swell potential.
Avonburg: AvA, AvB, AxA. Urban land part of AxA is too variable for interpretations.	Poor: seasonal high water table.	Moderate	Good	Unsuited	Fair: too silty; seasonal high water table.
Beasley: BeC2, BeD2	Fair: seasonal high water table at a depth of 1½ to 3 feet.	Moderate	Fair: clayey below a depth of 5 inches.	Unsuited	Poor: too clayey; high shrink-swell potential.
*Berks: BgF, BgG, BnD, BhF, BhG. For Muskingum parts, see Muskingum series, and for Neotoma parts of BhD, BhF, and BhG, see the Neotoma series.	Poor: sandstone and shale bedrock at a depth of 1½ to 3 feet.	Low	Poor: channery texture.	Unsuited	Poor: bedrock at a depth of 1½ to 3 feet; steep.
Blanchester: Bk	Poor: high water table.	High	Poor: high water table.	Unsuited	Poor: low strength; poorly drained soil.
*Boston: BmC2, BmC3, BmD2, BmD3, BmE2, BnB, BnB2, BoB, BoC. For Bratton parts of BmC2, BmC3, BmD2, BmD3, and BmE2, see Bratton series, and for Grayford parts of BnB and BnB2, see Grayford series. Urban land parts of BoB and BoC are too variable for interpretations.	Poor: high silt and clay content in subsoil.	Moderate	Fair: less than 16 inches of of suitable material.	Unsuited	Poor: low strength; clayey material below a depth of 30 inches.

engineering properties of the soils

such mapping units may have different properties and limitations, and for this reason it is necessary to refer to other series as indicated in of this table]

Soil features affecting—						
Highway location	Pond		Drainage of crops and pasture	Sprinkler irrigation	Terraces or diversions	Grassed waterways
	Reservoir areas	Embankments				
Subject to flooding; seasonal high water table; high frost heave potential.	Slow seepage rate; subject to stream overflow.	Fair to poor stability; slow seepage rate; subject to piping.	Moderate permeability; seasonal high water table.	Moderate infiltration rate; high available water capacity; seasonal high water table.	Nearly level; subject to flooding.	Nearly level; subject to flooding.
Seasonal high water table.	Slow seepage rate.	Fair stability and compaction characteristics; slow seepage rate; high shrink-swell potential.	Somewhat poorly drained; very slow permeability.	Seasonal high water table; very slow permeability; hazard of erosion in sloping areas.	Seasonal high water table; very slow permeability.	Seasonal high water table; very slow permeability.
Restricted internal drainage; seasonal high water table; fair stability.	Slow seepage rate; seasonal high water table.	Poor to fair stability and compaction characteristics; good core material.	Very slow permeability; seasonal high water table.	Very slow permeability; seasonal high water table; medium available water capacity.	Very slow permeability; seasonal high water table.	Moderately erodible; seasonal high water table.
Fair stability; moderate frost heave potential.	Slow seepage rate.	Hard to crack; slow permeability when compacted.	Moderately well drained; moderately slow permeability.	Slow infiltration rate; medium available water capacity.	Some areas are too sloping.	Moderately erodible.
Bedrock at a depth of 1½ to 3 feet; stoniness may hinder grading operations.	Medium to high seepage rate; fractured bedrock at a depth of 1½ to 3 feet.	Fair stability; moderate permeability when compacted; slight piping hazard; bedrock at a depth of 1½ to 3 feet.	Not needed	Medium to high infiltration rate; low available water capacity; steep.	Bedrock at a depth of 1½ to 3 feet; steep.	Moderately erodible; low available water capacity; steep.
High water table, clayey material; low strength; slow permeability.	High water table; very slow seepage rate.	Clayey material; slow permeability when compacted; poor compaction characteristics.	High water table; slow permeability; poor availability of outlets.	Slow permeability; high water table; medium available water capacity.	Not generally needed; nearly level; high water table.	Nearly level; high water table.
Fair stability; silty material may flow when wet; some frost heaving; bedrock at a depth of 3½ to 5 feet.	Slow seepage rate.	Fair stability; slow permeability when compacted; silty materials are subject to piping.	Well drained; moderately slow permeability.	Moderate infiltration rate; medium available water capacity; sloping areas are erodible.	Soil properties favorable; some areas are too sloping.	Erodes easily; some areas have steep slopes.

TABLE 6.—*Interpretations of*

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as a source of—		
			Topsoil	Sand and gravel	Road fill
Bratton: BpB, BpB2, BpC2, BpD2, BrD3.	Fair: clayey material; limestone bedrock at a depth of 2 to 3½ feet.	Moderate	Fair: thin layer of suitable material.	Unsuited	Poor: low strength; bedrock at a depth of 2 to 3½ feet.
Brookston: Bs, Bt	Poor: high water table.	High	Good	Unsuited	Poor: clayey material; high water table.
Cana: CaB, CaC2, CaD2, CaF	Fair: depth less than 5 feet to shale bedrock; clayey materials below a depth of 3 feet.	Moderate	Fair: less than 16 inches of suitable material. Poor where slopes are more than 12 percent.	Unsuited	Poor: shale bedrock at a depth of less than 5 feet; low strength.
Casco: CcD3, CcF2	Good: well drained; gravelly material.	Low	Poor: gravelly textures; steep slopes.	Good below a depth of 2 feet.	Fair: good below a depth of 2 feet.
*Celina: CeB, CfB, CgA, CgB. Urban land part of CfB is too variable for interpretations. For Xenia parts of CgA and CgB, see Xenia series.	Poor: seasonal high water table at a depth of 1 to 3 feet.	Moderate	Poor: thin layer.	Unsuited	Fair: silty material; moderate shrink-swell potential.
Cincinnati: ChB, ChC2, ChD2	Fair: silty and clayey material.	Moderate	Fair: thin layer; poor where slopes are more than 12 percent.	Unsuited	Fair: somewhat clayey material; moderate stability; low shrink-swell potential; erodible on slopes.
Clermont: Cm	Poor: high water table.	Moderate	Poor: high water table.	Unsuited	Poor: high water table; low strength.

engineering properties of the soils—Continued

Highway location	Soil features affecting— Pond		Drainage of crops and pasture	Sprinkler irrigation	Terraces or diversions	Grassed waterways
	Reservoir areas	Embankments				
Low strength; moderate shrink-swell potential; limestone bedrock at a depth of 2 to 3½ feet.	Slow seepage rate; limestone bedrock at a depth of 2 to 3½ feet has variable permeability.	Fair compaction characteristics; slow seepage rate; moderate shrink-swell potential.	Well drained; slow permeability; limestone bedrock at depth of 2 to 3½ feet.	Slow permeability; medium available water capacity; sloping areas are erodible.	Underlain with limestone bedrock at a depth of 2 to 3½ feet.	Moderately erodible.
High water table; clayey material; low stability.	High water table; very slow seepage rate.	Clayey material; slow permeability when compacted; poor compaction characteristics; moderate shrink-swell potential.	Moderately slow permeability; high water table.	High available water capacity; high water table.	Not generally needed; nearly level.	High water table; nearly level.
Low strength; some very steep slopes; shale bedrock at a depth of less than 5 feet.	Moderately slow seepage rate; shale bedrock at a depth of less than 5 feet.	Good stability and compaction characteristics; moderately slow seepage rate; shale bedrock at a depth of less than 5 feet.	Moderately well drained; moderately slow permeability; shale bedrock at a depth of less than 5 feet.	Moderate infiltration rate; medium available water capacity; erosion hazard in sloping areas.	Underlain with shale bedrock at a depth of less than 5 feet; some areas are too sloping.	Bedrock at a depth of less than 5 feet; some areas are too sloping.
Good stability; source of subbase; steep slopes.	High seepage rate; pervious sandy and gravelly material.	Good stability; high seepage rate when compacted.	Not needed	High infiltration rate; low available water capacity; steep slopes.	Steep slopes; moderately rapid permeability.	Low available moisture capacity; steep slopes.
Fair stability; some frost heaving.	Slow seepage rate.	Fair to good stability and compaction characteristics; slow seepage rate.	Moderately well drained; moderately slow permeability.	Moderate infiltration rate; medium available water capacity; moderately slow permeability.	Seasonal high water table at a depth of 1 to 3 feet.	Moderately erodible; seasonal high water table at a depth of 1 to 3 feet.
Moderate stability; some frost heaving; some steep slopes.	Moderately slow permeability.	Fair stability and compaction characteristics; slow seepage rate when compacted; slight piping hazard.	Not needed	Moderate infiltration rate; medium to high available water capacity; erosion hazard in sloping areas.	Suitable except if 12 to 35 percent slopes.	No adverse features, except generally not feasible if slope is more than 12 percent.
Restricted internal drainage; high water table; soft and unstable when wet.	High water table; low seepage rate.	Poor to fair stability and compaction characteristics; slow permeability when compacted.	Very slow permeability; high water table; poor availability of outlets.	Moderate to slow infiltration rate; high available water capacity; poorly drained.	Not needed; nearly level; high water table.	Nearly level; high water table.

TABLE 6.—*Interpretations of*

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as a source of—		
			Topsoil	Sand and gravel	Road fill
*Colyer: CoD2, CoF, CoG. For Trappist parts, see Trappist series.	Poor: shale bedrock at a depth of 1 to 1½ feet.	Moderate	Poor: thin layer.	Unsuited	Poor: shale bedrock at a depth of 1 to 1½ feet.
*Crosby: CrA, CsA, CsB, CuA. For Fincastle parts of CsA and CsB, see Fincastle series. Urban land part of CuA is too variable for interpretations.	Poor: seasonal high water table.	High	Fair: thin layer.	Unsuited	Fair: silty material; moderate shrink-swell potential.
Dana: DaA, DaB	Poor: seasonal high water table at a depth of 2 to 3 feet.	High	Fair: less than 16 inches of suitable material.	Unsuited	Fair: silty material; moderate shrink-swell potential.
Dubois: DuA, DuB	Poor: seasonal high water table.	High	Fair: 15 inches thick.	Unsuited	Fair: loamy and silty material.
Edenton: EbC2, EbD2, EbF2	Fair: clayey subsoil; bedrock at a depth of 2 to 3½ feet.	Moderate	Poor: thin layer; too sloping.	Unsuited	Poor: clayey material; bedrock at a depth of 2 to 3½ feet.
Eel: Ee	Poor: subject to flooding; seasonal high water table at a depth of 2 to 3 feet.	High	Good	Unsuited	Fair: silty material.
Fincastle. Mapped only in complexes with Crosby soils.	Poor: seasonal high water table.	High	Fair: less than 16 inches of suitable material.	Unsuited	Poor: silty material; moderate shrink-swell potential.

engineering properties of the soils—Continued

Soil features affecting—						
Highway location	Pond		Drainage of crops and pasture	Sprinkler irrigation	Terraces or diversions	Grassed waterways
	Reservoir areas	Embankments				
Shale bedrock at a depth of 1 to 1½ feet; some steeply sloping areas.	Shale bedrock at a depth of 1 to 1½ feet; moderately slow seepage rate.	Fair stability; slow permeability when compacted; slight piping hazard.	Not needed; shale bedrock at a shallow depth.	Moderate infiltration rate; low available water capacity; sloping to very steep slopes.	Shale bedrock at a depth of 1 to 1½ feet; most areas are too sloping.	Low available water capacity; sloping to very steep slopes.
Seasonal high water table; silty material may flow when wet; high frost heave potential.	Slow seepage rate; seasonal high water table.	Fair stability and compaction characteristics; slow seepage rate.	Slow permeability; seasonal high water table.	Medium to slow infiltration rate; medium available water capacity.	Seasonal high water table.	Slightly erodible; seasonal high water table.
Fair stability; silty material may flow when wet; some frost heaving.	Moderate seepage rate.	Fair stability; slow permeability when compacted.	Moderately well drained; moderate permeability; artificial drainage generally not needed.	Moderate infiltration rate; high available water capacity.	Soil properties favorable.	Slightly erodible.
High water table winter and spring; high frost heave potential; fairly easy to work.	Seasonal high water table; moderate to low seepage rate.	Fair to good stability and compaction characteristics; slow permeability when compacted; good resistance to piping.	Very slowly permeable fragipan; seasonal high water table.	Moderate infiltration rate; medium available water capacity.	Seasonal high water table.	Slightly erodible; seasonal high water table.
Fair stability; some frost heaving; bedrock at a depth of 2 to 3½ feet; some steep slopes.	Slow seepage rate; bedrock at a depth of 2 to 3½ feet; steep slopes.	Fair stability; slow permeability when compacted; fair resistance to piping; bedrock at a depth of 2 to 3½ feet.	Not needed	Moderately slow permeability; medium available water capacity; steep slopes.	Slowly permeable; fine material below a depth of about 2 feet; some steep slopes.	Highly erodible; some steep slopes.
Seasonal high water table at a depth of 2 to 3 feet.	Subject to stream overflow; moderate seepage rate; seams of sand in some places.	Fair compaction characteristics; fair resistance to piping; sandy strata in some places.	Moderately well drained; moderate permeability in the subsoil.	Moderate infiltration rate; high available water capacity.	Subject to flooding; nearly level.	Subject to flooding; nearly level.
Seasonal high water table; fair stability; silty material may flow when wet; high frost heave potential.	Moderately slow permeability; seasonal high water table.	Fair stability and compaction characteristics; slow seepage rate when compacted.	Moderately slow permeability; seasonal high water table.	Slow infiltration rate; high available water capacity.	Seasonal high water table.	Slightly erodible; seasonal high water table.

TABLE 6.—*Interpretations of*

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as a source of—		
			Topsoil	Sand and gravel	Road fill
Fitchville: FcA, FcB	Poor: seasonal high water table.	High	Good	Unsuited	Fair: silty and loamy material; seasonal high water table.
Fox: FlC2, FlD2, FnA, FnB, FoC3	Good: well drained.	Low	Fair: less than 16 inches of suitable material.	Good below a depth of 3½ feet.	Fair: good below depth of 2 to 3½eet.
Gasconade: GaC, GaD2, GbF2, GbG	Poor: clayey subsoil; bedrock at a depth of less than 2 feet.	Moderate	Poor: thin layer; sometimes flaggy.	Unsuited	Poor: clayey material; shallow to bedrock.
Genesee: Gn	Fair: subject to flooding.	Moderate	Good	Unsuited	Fair: silty material.
Grayford Mapped only in complexes with Boston soils.	Poor: clayey materials; bedrock at a depth of 3½ to 8 feet.	Moderate	Poor: thin layer.	Unsuited	Poor: clayey materials; low strength.
Guernsey: GuB, GuC, GvC3, GxD3	Poor: seasonal high water table at a depth of 1 to 3 feet.	Moderate	Fair: thin layer.	Unsuited	Poor: clayey materials; low strength.
Haubstadt: HbA, HbB, HbC2, HbC3, HbD2, HbD3, HcB, HcC. Urban land parts of HcB and HcC are too variable for interpretations.	Fair: seasonal high water table at a depth of 1 to 3 feet.	Moderate	Fair: less than 16 inches of suitable material.	Unsuited	Fair: loamy and silty material.

engineering properties of the soils—Continued

Soil features affecting—						
Highway location	Pond		Drainage of crops and pasture	Sprinkler irrigation	Terraces or diversions	Grassed waterways
	Reservoir areas	Embankments				
Fair to good stability; high frost heave potential; seasonal high water table.	Moderately slow permeability.	Fair to good stability and compaction characteristics; subject to piping.	Moderately slow permeability; seasonal high water table.	Moderate infiltration rate; medium to high available water capacity; seasonal high water table.	Seasonal high water table.	Slightly erodible; seasonal high water table.
Good stability; good source of subbase; low frost heave potential.	High seepage rate; pervious sand and gravelly material.	Good stability; high seepage rate; sandy and gravelly material.	Not needed	High infiltration rate; medium available water capacity.	Soil properties generally favorable, except terraces are generally not feasible on slopes of more than 12 percent.	Moderately to highly erodible; medium available water capacity.
Low stability; clayey material; bedrock at a depth of less than 2 feet.	Slow seepage rate; bedrock at a depth of less than 2 feet.	Fair to poor stability and compaction characteristics; slow seepage rate; shallow to bedrock.	Not generally needed; bedrock at a depth of less than 2 feet.	Slow infiltration rate; low available water capacity.	Soil properties favorable.	Moderately erodible; soil properties favorable.
Subject to flooding; low strength; some frost heaving.	Subject to stream overflow; moderate seepage rate; seams of sand in some places.	Fair compaction characteristics; fair resistance to piping.	Not generally needed; subject to flooding.	Moderate infiltration rate; high available water capacity; well drained.	Nearly level; subject to flooding.	Nearly level; subject to flooding.
Clayey materials; low strength; bedrock at a depth of 3½ to 8 feet; subject to moderate frost action.	Low seepage rate; limestone bedrock at a depth of 3½ to 8 feet.	Fair to poor stability and compaction characteristics; bedrock at a depth of 3½ to 8 feet.	Not generally needed.	Moderate permeability; medium available water capacity.	Bedrock is at a depth of 3½ to 8 feet; clayey subsoil.	Clayey subsoil; bedrock is at a depth of 3½ to 8 feet.
Fair to poor stability; moderate susceptibility to frost heaving; shale bedrock at a depth of 3½ to 7 feet.	Slow seepage rate; some steep slopes.	Fair to poor stability; slow permeability when compacted.	Moderately well drained; slow permeability.	Slow infiltration rate; medium available water capacity; gentle to steep slopes.	Slow permeability; some steep slopes.	Highly erodible on steep slopes; medium available water capacity.
Seasonal high water table in winter and spring; moderate frost heave potential.	Moderate to slow seepage rate; seasonal high water table at a depth of 1 to 3 feet.	Fair to good stability and compaction characteristics; slow permeability when compacted; good resistance.	Moderately well drained; slow permeability.	Moderate infiltration rate; medium available water capacity.	Slow permeability; some moderately steep slopes.	Highly erodible on steep slopes; slow permeability.

TABLE 6.—*Interpretations of*

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as a source of—		
			Topsoil	Sand and gravel	Road fill
*Hennepin: HeF2, HeG2, HfE3. For Miamian parts, see Miamian series.	Fair to good: loamy material in substrata.	Low	Poor: thin layer; steep slopes.	Unsuited	Fair: silty and loamy materials.
Hickory: HkC2, HkD2, HkE2, HkF2, HyC3, HyD3, HyE3.	Fair to good compaction properties; water table below a depth of 3 feet.	High	Poor: thin layer.	Unsuited	Fair: silty material; moderate shrink-swell potential.
Jessup: JeD	Fair: high silt and clay content in the subsoil.	Moderate	Fair: thin layer.	Unsuited	Poor: silty and clayey materials; low strength.
Johnsburg: JoC	Poor: seasonal high water table.	High	Fair: less than 16 inches of suitable material.	Unsuited	Poor: silty material.
Kendallville: KeB, KeC2, KeD2, KfD3	Fair: well drained; clay loam in subsoil.	Low	Poor: thin layer.	Unsuited	Fair: loamy material in upper 3 feet.
Lawshe: LhB, LhC2, LhD2, LlD3	Poor: clayey materials.	Moderate	Poor: too clayey.	Unsuited	Poor: high shrink-swell potential; low strength.
*Loudon: LoB, LoB2, LoC2, LoD2, LpE2. For Edenton part of LpE2, see Edenton series.	Poor: seasonal high water table at a depth of 1 to 3 feet.	Moderate	Fair: less than 16 inches of suitable material.	Unsuited	Poor: clayey materials below a depth of 2 feet; soft bedrock at a depth of 4 to 10 feet.
Markland: MdB, MdC2, MdD2	Poor: seasonal high water table at a depth of 1 to 3 feet; clayey subsoil.	Moderate	Poor: thin layer.	Unsuited	Poor: silty and clayey material.

engineering properties of the soils—Continued

Soil features affecting—						
Highway location	Pond		Drainage of crops and pasture	Sprinkler irrigation	Terraces or diversions	Grassed waterways
	Reservoir areas	Embankments				
Fair stability; steep slopes; cuts are droughty.	Slow seepage rate; steep slopes limit storage capacity.	Fair stability; slight piping hazard.	Not needed; steep slopes.	Moderate infiltration rate; low available water capacity; steep slopes.	Steep slopes; droughty soil.	Steep slopes; droughty soil.
High frost heave potential; moderate shrink-swell; sloping to very steep slopes.	Moderate permeability.	Fair to good compaction characteristics.	Moderate permeability; sloping to very steep slopes.	Medium to high available water capacity; sloping to very steep slopes.	Sloping to very steep slopes.	Sloping to very steep slopes.
Fair stability; may flow when wet; some frost heaving; bedrock at a depth of 4 to 10 feet.	Slow seepage rate.	Fair stability and compaction characteristics; low seepage potential.	Not needed-----	Moderate to slow infiltration rate; medium available water capacity; moderately steep slopes.	Slow permeability; moderately steep slopes.	Moderately erodible; slow permeability.
High water table in spring and summer; high frost heave potential; bedrock at a depth of 4 to 6 feet.	Seasonal high water table; slow seepage rate.	Fair stability and compaction characteristics; very slow permeability when compacted.	Very slow permeability in fragipan; seasonal high water table at a depth of 1 to 3 feet.	Slow infiltration rate; medium available water capacity.	Very slow permeability; seasonal high water table.	Very slow permeability; seasonal high water table.
Good stability; low frost heave potential.	Medium seepage rate.	Good stability and compaction characteristics; moderate seepage rate.	Not needed-----	Moderate infiltration rate; medium available water capacity; gentle to moderately steep slopes.	Some moderately steep slopes.	Moderate erosion limitation; some moderately steep slopes.
Clayey soil material; high shrink-swell potential; low strength; shale bedrock at a depth of 2½ to 5 feet.	Very slow permeability; shale bedrock at a depth of 2½ to 5 feet.	Poor compaction characteristics; low strength.	Moderately well drained; very slow permeability.	Very slow permeability; medium available water capacity; gentle to moderately steep slopes.	Clayey texture; very slow permeability; some moderately steep slopes.	Very slow permeability; some moderately steep slopes.
Fair stability; some frost heaving; bedrock at a depth of 4 to 10 feet.	Slow seepage rate.	Fair stability and compaction characteristics; low seepage potential.	Moderately well drained; slow permeability.	Slow infiltration rate; slow permeability; medium available water capacity; gentle to moderately steep slopes.	Slow permeability; some moderately steep slopes.	Slow permeability; easily erodible.
Fair stability; some frost heaving; some steep slopes.	Slow seepage rate.	Fair stability and compaction characteristics.	Moderately well drained; slow permeability.	Moderate to slow infiltration rate; medium available water capacity; gentle to steep slopes.	Slow permeability; some steep slopes.	Moderately erodible; slow permeability; some steep slopes.

TABLE 6.—*Interpretations of*

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as a source of—		
			Topsoil	Sand and gravel	Road fill
McGary: MgB	Poor: seasonal high water table; clayey subsoil.	Moderate	Fair: thin layer.	Unsuited	Poor: silty and clayey material; seasonal high water table.
*Miamian: MlB, MlB2, MlC2, MlD2, MlE, MmC3, MrB, MrB2, MrC2, MsB. For Russell parts of MrB, MrB2, and MrC2, see Russell series. Urban land part of MsD is too variable for interpretations.	Poor: high silt and clay content in the subsoil.	Moderate	Poor: thin layer; some steep slopes.	Unsuited	Fair: silty and clayey material.
Millsdale: Mt	Poor: high water table; hard bedrock at a depth of less than 4 feet.	High	Poor: high water table.	Unsuited	Poor: clayey materials; high shrink-swell potential; high water table.
Milton: MuB, MuB2, MuC2, MuD2, MwC3.	Poor: high silt and clay content in the subsoil; limestone bedrock at a depth of less than 4 feet.	Moderate	Fair: thin layer.	Unsuited	Fair: silty and clayey material; bedrock at a depth of less than 4 feet.
Montgomery: My	Poor: high water table.	Moderate	Poor: high water table.	Unsuited	Poor: clayey material; high water table.
Muse Mapped only in complexes with Trappist soils.	Poor: high clay content in subsoil.	Moderate	Fair: thin layer.	Unsuited	Poor: clayey materials.
Muskingum Mapped only in complexes with Berks soils and with Berks and Neotoma soils.	Poor: bedrock at a depth of less than 3½ feet.	Low	Poor: thin layer.	Unsuited	Fair: silty and loam material; poor on slopes of more than 25 percent; bedrock at a depth of less than 3½ feet.

engineering properties of the soils—Continued

Soil features affecting—						
Highway location	Pond		Drainage of crops and pasture	Sprinkler irrigation	Terraces or diversions	Grassed waterways
	Reservoir areas	Embankments				
Fair stability; moderate frost heave potential; seasonal high water table.	Very slow seepage rate; seasonal high water table.	Fair stability; very slow seepage rate.	Very slow permeability; seasonal high water table.	Moderate to slow infiltration rate; very slow permeability; medium available water capacity.	Very slow permeability.	Very slow permeability.
Fair to good stability; some frost heaving.	Slow seepage rate.	Fair to good stability and compaction characteristics; slow permeability when compacted; good core material.	Not needed; moderately slow permeability.	Moderate infiltration rate; medium available water capacity.	Some steep slopes.	Moderately to highly erodible; some steep slopes.
High water table; plastic clayey materials; low stability; bedrock at a depth of less than 4 feet.	Slow seepage rate; bedrock at a depth of less than 4 feet.	Poor stability and compaction characteristics; bedrock at a depth of less than 4 feet.	Very poorly drained; moderately slow permeability; bedrock at a depth of less than 4 feet.	Slow infiltration rate; high available water capacity; moderately slow permeability.	Very poorly drained; nearly level.	Slightly erodible; high water table; nearly level.
Fair stability; some frost heaving; limestone bedrock at a depth of less than 4 feet.	Medium seepage rate; limestone bedrock at a depth of less than 4 feet.	Fair stability and compaction characteristics; medium seepage rate; limestone bedrock at a depth of less than 4 feet.	Not needed	Medium infiltration rate; medium available water capacity; erosion hazard in sloping areas.	Underlain with limestone bedrock at a depth of less than 4 feet; some moderately steep slopes.	Moderate erosion hazard.
High water table; plastic clayey materials; low stability.	High water table; very slow seepage rate.	Clayey material; slow permeability when compacted; poor compaction characteristics.	Very poorly drained; slow permeability.	Slow infiltration rate; slow permeability; high available water capacity.	Very poorly drained; nearly level.	High water table; nearly level.
Plastic clayey materials; some sloping and moderately steep areas.	Some sloping and moderately steep areas.	Low strength; poor compaction characteristics.	Not needed	Slow permeability; erosion hazard in sloping areas.	Some moderately steep slopes.	Some moderately steep slopes.
Bedrock at a depth of less than 3 feet; stoniness may hinder grading operation; moderately steep to very steep slopes.	Medium to high seepage rate; with fractured bedrock at a depth of less than 3½ feet.	Fair stability; moderate permeability when compacted; slight piping hazard; less than 3½ feet to bedrock.	Not needed	Medium to high infiltration rate; low available water capacity; moderately steep to very steep slopes.	Moderately steep to very steep slopes.	Moderately steep to very steep slopes.

TABLE 6.—*Interpretations of*

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as a source of—		
			Topsoil	Sand and gravel	Road fill
*Negley: NdC, NdD, NdE, NdF, NeB, NfC3, NfD3, NgF. For Fox part of NgF, see Fox series.	Fair to good: sandy and gravelly materials; can generally be graded in winter.	Low	Fair: less than 16 inches of suitable material.	Poor: good below depth of 10 feet.	Good: stable
Neotoma Mapped only in complexes with Berks and Muskingum soils.	Poor: channery texture; bedrock at a depth of 3½ to 5 feet.	Low	Poor: channery texture.	Unsuited	Fair: silty and loamy material that is channery. Poor where slopes are more than 25 percent.
Nicholson: NnB, NnB2, NnC2	Fair: seasonal high water table at a depth of 1 to 3 feet.	Moderate	Good	Unsuited	Fair: moderate stability; low to moderate shrink-swell potential; easy to compact; erodible on slopes.
Ockley: OcA, OcB, OcC2, OdB Urban land part of OdB is too variable for interpretations.	Fair: good below a depth of 4 feet.	Low	Fair: thin layer.	Good below a depth of 5 feet.	Fair in upper 4 feet. Good below a depth of 4 feet.
Opequon: OpD2, OpE2, OsF2, OsG, OtD3	Poor: limestone bedrock at a depth less than 20 inches; well drained.	Moderate	Poor: thin layer.	Unsuited	Poor: clayey material; shallow to bedrock.
Otwell: OwB, OwC2, OwD2, OwE2, OwF	Fair: silty and loamy material; well drained.	Moderate	Fair: less than 16 inches of suitable material. Poor if slope is more than 15 percent.	Unsuited	Fair: silty and loamy material. Poor if slope is more than 25 percent.
Patton: Pa, Pb	Poor: high water table.	High	Poor: high water table.	Unsuited	Poor: high water table.
Peoga: Pe	Poor: high water table.	High	Poor: high water table.	Unsuited	Poor: high water table; silty and clayey materials.

engineering properties of the soils—Continued

Soil features affecting—						
Highway location	Pond		Drainage of crops and pasture	Sprinkler irrigation	Terraces or diversions	Grassed waterways
	Reservoir areas	Embankments				
Good stability; easy to work; low frost heave potential; some steep slopes.	High seepage rate; sandy and gravelly material.	Fair to good stability and compaction characteristics; subject to excessive seepage.	Not needed	High infiltration rate; medium available water capacity.	Soil properties favorable; some steep slopes.	Medium available water capacity; some steep slopes.
Bedrock at a depth of 3½ to 5 feet; channery and stony textures may hinder grading operations.	Medium to high seepage rate; fractured bedrock at a depth of 3½ to 5 feet.	Fair stability; moderate permeability when compacted.	Not needed	Medium to high infiltration rate; medium available water capacity; sloping to very steep.	Sloping to very steep.	Sloping to very steep.
Fair stability; some frost heaving.	Slow seepage rate.	Good stability and compaction characteristics; slight piping hazard.	Moderately well drained; slow permeability.	Moderate infiltration rate; medium available water capacity.	Slight wetness; slow permeability.	Moderately erodible; slow permeability.
Good stability; sandy and gravelly material is good for subbase; easy to work.	High seepage rate.	Good stability; high seepage rate.	Not needed	High infiltration rate; medium available water capacity.	Soil properties favorable.	Moderately erodible.
Limestone bedrock at a depth of less than 20 inches.	Medium seepage rate; limestone bedrock at a depth less than 20 inches.	Fair stability and compaction characteristics; slow seepage rate when compacted; shallow to bedrock.	Not needed	Moderate infiltration rate; low available water capacity; sloping to steeply sloping.	Shallow to limestone bedrock; some steep slopes.	Low available water capacity; shallow to bedrock.
Fair stability; some frost heaving; some very steep slopes.	Slow seepage rate.	Fair to good stability when compacted.	Not needed	Moderate infiltration rate; medium available water capacity.	Very slow permeability in fragipan; some very steep slopes.	Moderately erodible; very slow permeability in fragipan.
High water table; silty and clayey material; low stability.	Very slow seepage rate; stability.	Slow permeability when compacted; poor stability and compaction characteristics.	Very poorly drained; slow permeability.	Slow infiltration rate; high water table; high available water capacity.	Slow permeability; nearly level.	Slow permeability; nearly level.
High water table much of the year; susceptible to frost action.	Slow seepage rate; high water table.	Silty and clayey material; slow seepage rate when compacted; high water table.	Poorly drained; slow permeability.	High water table much of the year.	Slow permeability; nearly level.	Slow permeability; nearly level.

TABLE 6.—*Interpretations of*

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as a source of—		
			Topsoil	Sand and gravel	Road fill
Philo: Pn	Poor: subject to flooding; seasonal high water table at a depth of 1 to 3 feet.	High	Good	Unsuited	Fair: loamy material.
Ross: Rn	Poor: subject to flooding.	Moderate	Good	Unsuited	Fair: silty material.
Rossmoyne: RpA, RpB, RpB2, RpC2, RpD2, RsC3, RtB. Urban land part of RtB is too variable for interpretations.	Fair: seasonal high water table at a depth of 1 to 3 feet.	Moderate	Fair: less than 16 inches of suitable material.	Unsuited	Fair: moderate stability; low shrink-swell potential; easy to compact; erodible on slopes.
Russell: RuB	Fair: silty and clayey material.	Moderate	Fair: less than 16 inches of suitable material.	Unsuited	Fair: silty material.
Sardinia: SaA, SaB, SaC2	Poor: seasonal high water table at a depth of 1 to 3 feet.	Moderate	Fair: thin layer.	Unsuited	Fair: silty and and loamy material.
Shoals: Sh	Poor: subject to flooding; seasonal high water table.	High	Good	Unsuited	Poor: silty material.
Sleeth: SlA	Poor: seasonal high water table.	Moderate to high.	Good	Good	Fair: loamy material. Good below a depth of 5 feet.
Sloan: Sn	Poor: subject to flooding; high water table.	High	Poor: high water table.	Unsuited	Poor: silty material.
Stonelick: St	Poor: subject to flooding; loamy and sandy material.	Low	Fair: less than 16 inches of suitable marial.	Poor for sand; unsuited to gravel.	Fair: loamy material. Good below a depth of 3 feet.

engineering properties of the soils—Continued

Soil features affecting—						
Highway location	Pond		Drainage of crops and pasture	Sprinkler irrigation	Terraces or diversions	Grassed waterways
	Reservoir areas	Embankments				
Subject to flooding; low strength; high frost heave potential.	Subject to stream overflow; moderate seepage rate.	Fair stability and compaction characteristics; moderate permeability.	Moderately well drained; subject to flooding; moderate permeability.	Moderate infiltration rate; high available water capacity.	Nearly level; subject to flooding.	Nearly level; subject to flooding.
Subject to flooding; low strength; some frost heaving.	Subject to stream overflow; moderate seepage rate.	Fair compaction characteristics; fair resistance to piping.	Not needed	Moderate infiltration rate; high available water capacity.	Nearly level; subject to flooding.	Nearly level; subject to flooding.
Fair stability; some frost heaving; seasonal high water table at a depth of 1 to 3 feet.	Slow seepage rate.	Fair stability and compaction characteristics; slow seepage rate.	Moderately well drained; slow permeability.	Medium to slow infiltration rate; medium available water capacity.	Slow permeability; some moderately steep slopes.	Highly erodible; slow permeability.
Fair to good stability; some frost heaving.	Moderate seepage rate.	Good stability and compaction characteristics; slow seepage rate when compacted; subject to piping.	Not needed	Moderate infiltration rate; high available water capacity.	Soil properties favorable; some moderately steep slopes.	Moderately erodible; soil properties favorable.
Fair to good stability; some frost heaving.	Moderate seepage rate.	Good stability and compaction characteristics; moderate seepage rate.	Moderately well drained; moderate permeability.	Moderate infiltration rate; medium available water capacity.	Soil properties favorable.	Moderately erodible; soil properties favorable.
Subject to flooding; seasonal high water table; low strength; high frost heave potential.	Subject to stream overflow; moderate seepage rate; permeable layers in the substratum.	Fair compaction characteristics; fair resistance to piping; alluvial soil may have sandy strata.	Somewhat poorly drained; moderate permeability in subsoil; poor availability of outlets.	Moderate infiltration rate; high available water capacity; somewhat poor natural drainage.	Not needed; nearly level; subject to flooding.	Nearly level; subject to flooding.
Good stability; good source for subbase; easy to work.	High seepage rate; pervious; sandy and gravelly material.	Good stability; moderate to high seepage rate; sandy and gravelly material.	Moderate permeability.	Moderate infiltration rate; high available water capacity.	Soil properties favorable.	Slightly erodible on gentle slopes.
Subject to flooding; high water table; low strength; high frost heave potential.	Subject to flooding; high water table; moderate seepage rate.	Fair to poor stability; moderate seepage rate; subject to piping.	Very poorly drained; moderate permeability; poor availability of outlets.	Moderate infiltration rate; high available water capacity; very poor natural drainage.	Not needed; nearly level; subject to flooding.	Soil properties favorable; nearly level; subject to flooding.
Subject to flooding; loamy and sandy material.	Moderately rapid seepage rate.	Good stability; moderately rapid seepage rate when compacted.	Not needed	Low available water capacity; moderately rapid permeability; subject to flooding.	Nearly level; subject to flooding.	Subject to flooding.

TABLE 6.—*Interpretations of*

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as a source of—		
			Topsoil	Sand and gravel	Road fill
Thackery: ThA, ThB	Fair: seasonal high water table at a depth of 1 to 3 feet.	Moderate	Fair: less than 16 inches of suitable material.	Fair: good below a depth of 4 feet.	Fair: silty and loamy material. Good below a depth of 4 feet.
*Trappist: TrE, TsB, TsC2, TsD2. For Muse parts of TsB, TsC2, and TsD2, see Muse series.	Fair: silty and clayey material; shale bedrock at a depth of 2 to 3 feet.	Moderate	Poor: thin layer.	Unsuited	Poor: silty and clayey material; bedrock at a depth of 2 to 3 feet.
Tuscarawas: TuD, TuF	Fair: clayey substratum.	High	Poor: channery texture.	Unsuited	Poor: clayey substratum; low strength.
Warsaw: WaA	Good: well drained gravelly material.	Low	Good	Good	Good: gravelly material.
Wea: WeA, WeB	Good: well drained; sandy and gravelly material.	Low	Good	Good below a depth of 4 feet.	Good: loamy and gravelly material.
Wellston: WIC, WID	Fair: well drained; silty and loamy material; bedrock at a depth of 3 to 6 feet.	Moderate	Fair: thin layer.	Unsuited	Fair: silty and loamy material; sandstone and shale bedrock at a depth of 3 to 6 feet.
Westland: Ws, Wt	Poor: high water table.	High	Poor: high water table.	Fair to good below a depth of 4 feet.	Poor: high water table.
Williamsburg: WvA, WvB, WvC	Poor: silty and clayey material in subsoil.	Low	Fair: poor if slope is more than 12 percent.	Unsuited: possible source at greater depth.	Fair: silty and loamy material.
Xenia: XeB	Poor: high content of silt and clay in subsoil; seasonal high water table at a depth of 1 to 3 feet.	High	Fair: less than 16 inches of suitable material.	Unsuited	Poor: silty material.

engineering properties of the soils—Continued

Soil features affecting—						
Highway location	Pond		Drainage of crops and pasture	Sprinkler irrigation	Terraces or diversions	Grassed waterways
	Reservoir areas	Embankments				
Good stability; good source for subbase; easy to work.	Moderate to high seepage rate; loamy and gravelly material.	Good stability; moderate to high seepage rate.	Moderately well drained; moderate permeability.	Moderate infiltration rate; high available water capacity.	Soil properties favorable.	Moderately erodible.
Fair stability; some frost heaving; shale bedrock at a depth of 2 to 3 feet; some steep slopes.	Slow seepage rate.	Good stability and compaction characteristics; slow seepage rate.	Not needed	Moderate infiltration rate; medium to low available water capacity; gentle to steep slopes.	Shale bedrock at a depth of 2 to 3 feet; some steep slopes.	Highly erodible; bedrock at a depth of 2 to 3 feet.
Fair to good stability; high frost heave potential.	Slow seepage rate.	Fair to good stability and compaction characteristics; slow seepage rate.	Not generally needed.	Moderate infiltration rate; medium to low available water capacity.	Slow permeability; some steep or very steep slopes.	Moderately erodible; slow permeability; some very steep slopes.
Good stability; good source for subbase; low frost heave potential.	High seepage rate; pervious gravelly material.	Good stability and compaction characteristics; high seepage rate.	Not needed	Rapid infiltration rate; medium to low available water capacity.	Soil properties favorable.	Moderately erodible; medium to low available water capacity.
Good stability; good source for subbase; low frost heave potential.	High seepage rate; pervious sandy and gravelly material in substratum.	Good stability and compaction characteristics; high seepage rate.	Not needed	Rapid infiltration rate; medium available water capacity.	Soil properties favorable.	Slightly erodible.
Sandstone and shale bedrock at a depth of 3 to 6 feet; silty and loamy materials.	Moderate seepage rate.	Fair stability and compaction characteristics; slow seepage rate when compacted; subject to piping.	Not needed	Moderate infiltration rate; medium available water capacity; erosion hazard in sloping areas.	Soil properties favorable; bedrock at a depth of 3 to 6 feet; some moderately steep slopes.	Moderately erodible; soil properties favorable.
High water table; good stability; high frost heave potential.	High seepage rate; gravelly material; high water table most of the year.	Good stability and compaction characteristics; moderate permeability; poor core material.	Very poorly drained; moderate to slow permeability.	Moderate infiltration; high available water capacity; high water table.	Not needed; nearly level; very poorly drained.	Nearly level; very poorly drained.
Fair stability; silty and loamy materials; some steep slopes.	Moderate seepage rate.	Fair stability and compaction characteristics; moderate to slow seepage rate when compacted.	Not needed	Moderate infiltration rate; medium available water capacity; erosion hazard on slopes.	Soil properties favorable; some steep slopes.	Highly erodible some steep slopes.
Fair stability; high frost heave potential.	Slow seepage rate.	Good stability and compaction characteristics; slow seepage rate.	Moderately well drained; moderately slow permeability.	Moderate infiltration rate; medium to high available water capacity.	Soil properties favorable.	Moderately erodible; soil properties favorable.

and the workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material and the shrink-swell potential indicate traffic supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Embankments require soil material resistant to seepage and piping and of favorable stability shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are among factors that are unfavorable.

Drainage of crops and pasture is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope, stability in ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, water erosion or soil blowing; soil texture; content of stones; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer and in fragipans or other layers that restrict movement of water; amount of water held available to plants; and need for drainage, or depth to water table or bedrock.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff and seepage so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or other unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

The layout and construction of grassed waterways are affected by such soil properties as texture, depth, and erodibility of the soil material; presence of stones or rock outcrops; and the steepness of slopes. Other factors that affect waterways are seepage, natural soil drainage, available water capacity, susceptibility to siltation and the ease of establishing and maintaining vegetation.

Soil and Land Use Planning for Town and Country Development

Most of Highland County has been used for farming in the past, but large areas are now used for residential, commercial, industrial, transportation, and recreation (fig. 2) purposes. A large part of the county is presently idle or is used for nonfarm activities.

This section provides information about the properties of the soils and their effect on some nonfarm uses of land.

Figure 2.—Recreation area on Rocky Fork Lake. The soil is gently sloping Haubstadt silt loam.

It can help community planners and industrial users of land find areas that are least costly to develop and maintain. Land use planners can find other information in the detailed soil maps. Table 7 gives the estimated degree and kinds of limitations of soils for some land uses. Because extensive manipulation of the soil alters some of its natural properties, the ratings for some uses will not apply to areas that have undergone extensive cutting and filling.

The estimated degree of limitations of the soils for a land use are described as slight, moderate, and severe. A rating of *slight* indicates that the soil has no important limitations for the use. *Moderate* shows that the soil has some limitations, but they can be overcome or corrected. *Severe* indicates that the soil has serious limitations that are costly and difficult to overcome.

Following are explanations of some of the columns in table 7.

Cultivated crops.—The degree of limitation is affected by the slope, hazard of erosion, and drainage.

Septic tank absorption fields.—Most of the soils in the county have some limitations for disposing of effluent from septic tanks. These include excessive slope, a seasonal high water table, restricted permeability, poor natural drainage, flooding, and limited depth to bedrock. Flooding and a seasonal high water table can hinder proper functioning of disposal fields. All soils subject to flooding have been rated severe.

Many of the soils in the county have been rated severe for septic tank use because of moderately slow or slow permeability. A severe limitation can be caused by a restrictive layer, such as shale or rock, or by a dense, compact layer, such as the fragipan in Rossmoyne soils, that interferes with adequate filtration and the movement of effluent. If filter beds for septic tanks are in areas where the slope is more than 12 percent, erosion and seepage can be limiting factors, or the soil can become unstable when saturated.

Some soils have a gravelly and sandy substratum. Septic tanks on these soils can contaminate the ground water or nearby springs, lakes, or streams. Quick disposal of effluents can indicate that underground water supplies are being polluted. Before a septic tank system is installed, an investigation should be made at the site to determine the suitable design or alternative solutions to overcome the soil limitations.

Sewage lagoons.—Sewage lagoons are shallow ponds built to dispose of sewage through oxidation. Among the features that affect lagoons are the hazard of flooding, degree of slope, depth to bedrock, permeability, coarse fragments, and organic-matter content.

Dwellings.—Major soil features that affect the soils used for homesites are limited depth to bedrock, flooding, poor natural drainage, and excessive slope. Disposal of sewage is not considered. The ratings in table 7 are for houses of three stories or less with or without a basement, but the ratings also apply to sites for small industrial, commerical, and other buildings.

Soils subject to flooding have severe limitations for permanent structures. Homes on naturally wet soils may have wet basements unless adequate drainage is provided. The Avonburg, Blanchester, Clermont, and McGary soils have a hazard of wetness. In some areas, open ditch drains have been installed for agricultural uses. Excavations in these areas for buildings can disrupt this drainage system.

Some soils, such as Avonburg or Clermont soils, have a high content of silt. They are not as suitable for supporting structural foundations as the coarser textured Fox and Ockley soils. A high shrink-swell property can cause foundations to heave and crack, and it can affect the alinement of sidewalks, patios, floors, and rock walls. A subgrade or layers of sandy or gravelly material below the structure can overcome this limitation.

Excavating basements and installing underground utility lines is difficult and expensive in soils that have a limited depth to bedrock. Areas where the slope is more than 12 percent have an erosion hazard as well as limitations for excavating and leveling.

Local roads and streets.—The ratings in table 7 are for soils used for roads and streets in residential areas where traffic is light. The hazard of flooding, slope, depth to and kind of bedrock, depth to the water table, and the degree of stoniness affect roads and streets. The estimated soil properties and features that are important in designing, constructing, and maintaining highways are given in the section, "Engineering Uses of Soils."

Shallow excavations.—The ratings for excavations to a depth of less than 6 feet are affected by the workability of the soil, resistance to sloughing, slope, rock outcrops and big stones, hazard of flooding, and seasonal high water table.

Sanitary landfill.—Among the properties affecting the use of soils for the trench type of sanitary landfill are depth to rock, seasonal wetness, permeability, slope, texture of the soil material, and hazard of flooding. Deep, nearly level, well-drained soils that have slow permeability generally have the fewest limitations for sanitary landfills. Ponding or a high water table increases the difficulty of excavation and proper covering. Clayey soils are less desirable for cover than coarse soils, because they are hard to grade and are subject to cracking when dry. All soils that have bedrock within a depth of 60 inches are rated severe.

Lawns, landscaping, and golf fairways.—In most areas developed for homes and golf courses, the natural surface soil, or topsoil, can be used for lawns, flowers, shrubs, and trees. It can be removed from the site, stored until construction and grading are completed, and then returned. The natural surface soil from areas graded for streets also can be saved and used for lawns and fairways. Among the soil properties that affect a lawn or golf fairway are natural drainage, degree of slope, depth to bedrock, texture of the surface soil, stoniness and rockiness, and hazard of flooding.

Playgrounds.—Natural drainage, slope, depth to the water table, depth to and kind of bedrock, permeability, degree of stoniness, hazard of flooding, and texture of the surface soil are properties to consider when selecting sites for use as athletic fields and other intensive play areas. In table 7 the use of fill material from other areas was not considered in the ratings. Soils on flood plains can be used for baseball and other intensive play areas that are not subject to costly damage by flooding. The ratings given for local roads and streets should be considered before building tennis courts.

TABLE 7.—*Degree and kind of limitations of the*

Soil series and map symbols	Cultivated crops	Septic tank absorption fields	Sewage lagoons	Dwellings		Local roads and streets
				With basement	Without basement	
Algiers: Ag	Slight	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding; seasonal high water table.	Severe: subject to flooding.	Severe: subject to flooding; highly susceptible to frost action.
Atlas: AtB, AtB2	Moderate: wetness.	Severe: very slow permeability; seasonal high water table.	Moderate: slope.	Severe: seasonal high water table; high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: high shrink-swell potential; low strength.
AtC2, AtC3	Severe: slope; hazard of erosion.	Severe: very slow permeability; seasonal high water table.	Severe: slope	Severe: seasonal high water table; high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: high shrink-swell potential; low strength.
Avonburg: AvA, AxA	Moderate: wetness.	Severe: very slow permeability; seasonal high water table.	Slight	Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table; low strength.
Urban land part of AxA is too variable to be rated.						
AvB	Moderate: wetness.	Severe: very slow permeability; seasonal high water table.	Moderate: slope.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table; low strength.
Beasley: BeC2	Severe: slope; erosion.	Severe: slow permeability; limited depth to bedrock.	Severe: depth to bedrock; slope.	Severe: high shrink-swell potential; low strength.	Severe: high shrink-swell potential; low strength.	Severe: high shrink-swell potential; low strength.
BeD2	Severe: slope; erosion.	Severe: slow permeability; depth to bedrock; slope.	Severe: depth to bedrock; slope.	Severe: high shrink-swell potential; low strength; slope.	Severe: high shrink-swell potential; low strength; slope.	Severe: high shrink-swell potential; low strength; slope.
Berks: BgF, BgG, BhF, BhG. Berks and Muskingum parts.	Severe: slope; erosion.	Severe: slope; depth to bedrock.	Severe: slope; depth to bedrock.	Severe: slope	Severe: slope	Severe: slope
Neotoma part of BhF and BhG.	Severe: slope; erosion.	Severe: slope	Severe: slope; moderately rapid permeability.	Severe: slope	Severe: slope	Severe: slope
BhD. Berks and Muskingum parts.	Severe: slope; susceptible to erosion.	Severe: slope; depth to bedrock.	Severe: slope; depth to bedrock.	Severe: slope	Severe: slope	Severe: slope
Neotoma part	Severe: slope; erosion.	Severe: slope	Severe: slope; moderately rapid permeability.	Severe: slope	Severe: slope	Severe: slope
Blanchester: Bk	Slight	Severe: slow permeability; high water table.	Slight	Severe: high water table.	Severe: high water table.	Severe: low strength; high water table.

See footnotes at end of table.

soils for town and country development

Shallow excavations	Sanitary landfill (trench) [1]	Lawns, landscaping, and golf fairways	Playgrounds	Picnic areas	Camp areas	Paths and trails
Severe: subject to flooding; seasonal high water table.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding; seasonal high water table.	Moderate: subject to flooding; seasonal high water table.	Severe: subject to flooding; seasonal high water table.	Moderate: seasonal high water table.
Severe: seasonal high water table.	Severe: too clayey.	Severe: very slow permeability.	Severe: very slow permeability; seasonal high water table.	Moderate: seasonal high water table.	Severe: very slow permeability; seasonal high water table.	Moderate: seasonal high water table.
Severe: seasonal high water table.	Severe: too clayey.	Severe: very slow permeability.	Severe: very slow permeability; seasonal high water table; slope.	Moderate: seasonal high water table; slope.	Severe: very slow permeability; seasonal high water table.	Moderate: seasonal high water table.
Severe: seasonal high water table.	Moderate: seasonal high water table.	Severe: very slow permeability.	Severe: very slow permeability; seasonal high water table.	Moderate: seasonal high water table.	Severe: very slow permeability; seasonal high water table.	Moderate: seasonal high water table.
Severe: seasonal high water table.	Moderate: seasonal high water table.	Severe: very slow permeability.	Severe: very slow permeability; seasonal high water table.	Moderate: seasonal high water table.	Severe: very slow permeability; seasonal high water table.	Moderate: seasonal high water table.
Severe: too clayey.	Severe: depth to bedrock; too clayey.	Severe: slow permeability.	Severe: slope	Moderate: slope.	Moderate: slow permeability; seasonal high water table; slope.	Slight.
Severe: too clayey; slope.	Severe: depth to bedrock; too clayey.	Severe: slow permeability; slope.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Severe: slope; depth to rock.	Severe: slope; depth to rock.	Severe: slope; channery surface layer.	Severe: slope; channery surface layer.	Severe: slope	Severe: slope	Severe: slope.
Severe: slope	Severe: slope; depth to rock.	Severe: slope; channery surface layer.	Severe: slope; channery surface layer.	Severe: slope	Severe: slope	Severe: slope.
Severe: slope; depth to rock.	Severe: depth to rock.	Severe: slope; channery surface layer.	Severe: slope; channery surface layer.	Severe: slope	Severe: slope	Moderate: slope.
Severe: slope	Severe: depth to rock.	Severe: slope; channery surface layer.	Severe: slope; channery surface layer.	Severe: slope	Severe: slope	Moderate: slope.
Severe: high water table.	Severe: too clayey; high water table.	Severe: high water table; slow permeability.	Severe: high water table; slow permeability.	Severe: high water table.	Severe: slow permeability; high water table.	Severe: high water table.

TABLE—7. *Degree and kind of limitations of the*

Soil series and map symbols	Cultivated crops	Septic tank absorption fields	Sewage lagoons	Dwellings		Local roads and streets
				With basement	Without basement	
Boston:						
BmC2, BmC3, BoC—For Bratton parts of BmC2 and BmC3, see BpC2 in Bratton series. Urban land part of BoC is too variable to be rated.	Moderate: slope; erosion; severe on severely eroded units.	Severe: moderately slow permeability; depth to rock.[2]	Severe: slope.[2]	Moderate: depth to rock; moderate shrink-swell potential; slope.	Moderate: low strength; moderate shrink-swell potential; slope.	Moderate: moderate frost action; low strength.
BmD2, BmD3, BmE2—For Bratton parts see BpD2 and BrD3 in the Bratton series.	Severe: slope; erosion.	Severe: moderately slow permeability; depth to rock; slope.[2]	Severe: slope.[2]	Severe: slope.	Severe: slope.	Severe: slope.
BnB, BnB2, BoB—Ratings are for both Boston and Grayford soils in BnB and BnB2. Urban land part of BoB is too variable to be rated.	Slight	Severe: depth to rock; moderate to moderately slow permeability.[2]	Moderate: slope; depth to rock.[2]	Moderate: depth to rock; moderate shrink-swell potential.	Moderate: low strength; moderate shrink-swell potential.	Moderate: moderately susceptible to frost action; low strength.
Bratton:						
BpB, BpB2	Slight	Severe: depth to rock; moderately slow permeability.[2]	Severe: depth to rock.[2]	Severe: depth to rock.	Moderate: depth to rock; moderate shrink-swell potential.	Severe: low strength.
BpC2	Moderate: slope; erosion.	Severe: depth to rock; moderately slow permeability.[2]	Severe: depth to rock; slope.[2]	Severe: depth to rock.	Moderate: depth to rock; moderate shrink-swell potential; slope.	Severe: low strength.
BpD2, BrD3	Severe: slope; erosion.	Severe: depth to rock; moderately slow permeability; slope.[2]	Severe: depth to rock; slope.[2]	Severe: depth to rock; slope.	Severe: slope.	Severe: low strength; slope.
Brookston: Bs, Bt	Slight	Severe: moderately slow permeability; high water table.	Severe: high water table; subject to ponding.	Severe: high water table; subject to ponding.	Severe: high water table; subject to ponding.	Severe: high water table; highly susceptible to frost action.
Cana:						
CaB	Slight	Severe: slow permeability.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Severe: low strength.
CaC2	Moderate: slope; erosion.	Severe: slow permeability.	Severe: slope; depth to rock.	Severe: depth to rock.	Moderate: depth to rock; slope.	Severe: low strength.
CaD2	Severe: slope; erosion.	Severe: slow permeability; slope.	Severe: depth to rock; slope.	Severe: depth to rock; slope.	Severe: slope.	Severe: low strength; slope.
CaF	Severe: slope; erosion.	Severe: slow permeability; slope.	Severe: depth to rock; slope.	Severe: depth to rock; slope.	Severe: slope.	Severe: low strength; slope.

See footnotes at end of table.

soils for town and country development—Continued

Shallow excavations	Sanitary landfill (trench) [1]	Lawns, landscaping, and golf fairways	Playgrounds	Picnic areas	Camp areas	Paths and trails
Moderate: depth to rock; slope.	Severe: depth to rock.[2]	Moderate: moderately slow permeability; slope.	Severe: slope	Moderate: slope.	Moderate: moderately slow permeability; slope.	Slight.
Severe: slope	Severe: depth to rock.[2]	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Moderate: depth to rock.	Severe: depth to rock.[2]	Moderate: medium available water capacity; mod-moderate to moderately slow permeability.	Moderate: slope; moderate to moderately slow permeability.	Slight	Slight; moderate for Boston part: moderately slow permeability.	Slight.
Severe: depth to rock.	Severe: depth to rock.[2]	Moderate: depth to rock; moderately slow permeability.	Moderate: moderately slow permeability; depth to rock.	Slight	Moderate: moderately slow permeability.	Slight.
Severe: depth to rock.	Severe: depth to rock.[2]	Moderate: depth to rock; moderately slow permeability; slope.	Severe: slope	Moderate: slope.	Moderate: moderately slow permeability; slope.	Slight.
Severe: depth to rock; slope.	Severe: depth to rock.[2]	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Moderate: depth to rock.	Severe: depth to bedrock.	Severe: slow permeability.	Moderate: slope; slow permeability.	Slight	Moderate: slow permeability.	Slight.
Moderate: depth to rock; slope.	Severe: depth to bedrock.	Severe: slow permeability.	Severe: slope	Moderate: slope.	Moderate: slow permeability; slope.	Slight.
Severe: slope	Severe: depth to bedrock.	Severe: slow permeability; slope.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Severe: slope	Severe: depth to bedrock; slope.	Severe: slow permeability; slope.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.

TABLE—7. *Degree and kind of limitations of the*

Soil series and map symbols	Cultivated crops	Septic tank absorption fields	Sewage lagoons	Dwellings		Local roads and street
				With basement	Without basement	
Casco:						
CcD3	Severe: slope; erosion.	Severe: slope [2]	Severe: slope; moderately rapid permeability.[2]	Severe: slope	Severe: slope	Severe: slope
CcF2	Severe: slope; erosion.	Severe: slope [2]	Severe: slope; moderately rapid permeability.[2]	Severe: slope	Severe: slope	Severe: slope
Celina:						
CeB, CfB, CgB. Urban land part of CfB is too variable to be rated. For Xenia part of CgB, see XeB in Xenia series.	Slight	Severe: moderately slow permeability.	Slight	Moderate: seasonal high water table.	Slight	Moderate: subject to frost action.
CgA. Ratings are for both Celina and Xenia soils.	Slight	Severe: moderately slow permeability.	Slight	Moderate: seasonal high water table.	Slight	Moderate: subject to frost action.
Cincinnati:						
ChB	Slight	Severe: moderately slow permeability.	Moderate: moderately slow permeability; slope.	Slight	Slight	Moderate: subject to frost action.
ChC2	Moderate: slope; erosion.	Severe: moderately slow permeability.	Severe: slope	Moderate: slope.	Moderate: slope.	Moderate: subject to frost action; slope.
ChD2	Severe: slope; erosion.	Severe: moderately slow permeability; slope.	Severe: slope	Severe: slope	Severe: slope	Severe: slope
Clermont: Cm	Moderate: wetness.	Severe: very slow permeability; seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.
Colyer:						
CoD2. For Trappist part, see TrE in Trappist series.	Severe: shallow to bedrock.	Severe: shallow to bedrock; slope.	Severe: shallow to bedrock; slope.	Severe: shallow to bedrock; slope.	Severe: slope	Severe: slope
CoF, CoG.						
Colyer part	Severe: shallow to bedrock; slope.	Severe: shallow to bedrock; slope.	Severe: shallow to bedrock; slope.	Severe: shallow to bedrock; slope.	Severe: slope	Severe: slope
Trappist part	Severe: slope; erosion.	Severe: slope; slow permeability.	Severe: slope	Severe: slope	Severe: slope	Severe: slope; low strength.

See footnotes at end of table.

soils for town and country development—Continued

Shallow excavations	Sanitary landfill (trench) [1]	Lawns, landscaping, and golf fairways	Playgrounds	Picnic areas	Camp areas	Paths and trails
Severe: slope	Severe: moderately rapid permeability.[2]	Severe: slope; low available water capacity.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Severe: slope	Severe: moderately rapid permeability; slope.[2]	Severe: slope; low available water capacity.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Moderate: seasonal high water table.	Moderate: too clayey.	Moderate: moderately slow permeability.	Moderate: moderately slow permeability; seasonal high water table; slope.	Slight	Moderate: moderately slow permeability; seasonal high water table.	Slight.
Moderate: seasonal high water table.	Moderate: too clayey.	Moderate: moderately slow permeability.	Moderate: morderately slow permeability; seasonal high water table.	Slight	Moderate: moderately slow permeability; seasonal high water table.	Slight.
Slight	Moderate: too clayey.	Moderate: moderately slow permeability.	Moderate: moderately slow permeability; slope.	Slight	Moderate: moderately slow permeability.	Slight.
Moderate: slope.	Moderate: too clayey.	Moderate: moderately slow permeability.	Severe: slope	Moderate: slope.	Moderate: moderately slow permeability; slope.	Slight.
Severe: slope	Moderate: too clayey; slope.	Moderate: moderately slow permeability; slope.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: very slow permeability; seasonal high water table.	Severe: very slow permeability; seasonal high water table.	Severe: seasonal high water table.	Severe: very slow permeability; seasonal high water table.	Severe: seasonal high water table.
Severe: slope	Severe: shallow to shale bedrock.	Severe: low available water capacity; slope.	Severe: slope; shallow to bedrock.	Severe: slope	Severe: slope	Moderate: slope.
Severe: slope	Severe: shallow to shale bedrock; slope.	Severe: slope; low available water capacity.	Severe: slope; shallow to bedrock.	Severe: slope	Severe: slope	Severe: slope.
Severe: slope	Severe: slope	Severe: slope; slow permeability.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.

TABLE 7.—*Degree and kind of limitations of the*

Soil series and map symbols	Cultivated crops	Septic tank absorption fields	Sewage lagoons	Dwellings		Local roads and streets
				With basement	Without basement	
Crosby: CrA, CsA, CuA. Urban land part of CuA is too variable to be rated.						
Crosby part	Slight	Severe: slow permeability; seasonal high water table.	Slight	Severe: seasonal high water table.	Moderate: seasonal high water table.	Severe: subject to frost action.
Fincastle part of CsA	Slight	Severe: moderately slow permeability; seasonal high water table.	Slight	Severe: seasonal high water table.	Moderate: seasonal high water table.	Severe: subject to frost action.
CsB. Crosby part	Slight	Severe: slow permeability; seasonal high water table.	Moderate: slope.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Severe: subject to frost action.
Fincastle part	Slight	Severe: moderately slow permeability; seasonal high water table.	Moderate: slope.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Severe: subject to frost action.
Dana: DaA	Slight	Moderate: moderate permeability; seasonal high water table.	Moderate: moderate permeability.	Moderate: seasonal high water table.	Slight	Severe: subject to frost action.
DaB	Slight	Moderate: moderate permeability; seasonal high water table.	Moderate: moderate permeability; slope.	Moderate: seasonal high water table.	Slight	Severe: subject to frost action.
Dubois: DuA	Moderate: wetness.	Severe: very slow permeability; seasonal high water table.[2]	Slight[2]	Severe: seasonal high water table.	Moderate: seasonal high water table.	Severe: subject to frost action.
DuB	Moderate: wetness.	Severe: very slow permeability; seasonal high water table.[2]	Moderate: slope.[2]	Severe: seasonal high water table.	Moderate: seasonal high water table.	Severe: subject to frost action.

See footnotes at end of table.

soils for town and country development—Continued

Shallow excavations	Sanitary landfill (trench) [1]	Lawns, landscaping, and golf fairways	Playgrounds	Picnic areas	Camp areas	Paths and trails
Severe: seasonal high water table.	Moderate: seasonal high water table.	Severe: slow permeability.	Moderate: slow permeability; seasonal high water table.	Moderate: seasonal high water table.	Moderate: slow permeability; seasonal high water table.	Moderate: seasonal high water table.
Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: moderately slow permeability; seasonal high water table.	Moderate: moderately slow permeability; seasonal high water table.	Moderate: seasonal high water table.	Moderate: moderately slow permeability; seasonal high water table.	Moderate: seasonal high water table.
Severe: seasonal high water table.	Moderate: seasonal high water table.	Severe: slow permeability.	Moderate: slow permeability; seasonal high water table; slope.	Moderate: seasonal high water table.	Moderate: slow permeability; seasonal high water table.	Moderate: seasonal high water table.
Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: moderately slow permeability; seasonal high water table.	Moderate: moderately slow permeability; seasonal high water table; slope.	Moderate: seasonal high water table.	Moderate: moderately slow permeability; seasonal high water table.	Moderate: seasonal high water table.
Moderate: seasonal high water table.	Moderate: seasonal high water table.	Slight	Moderate: seasonal high water table.	Slight	Moderate: seasonal high water table.	Slight.
Moderate: seasonal high water table.	Moderate: seasonal high water table.	Slight	Moderate: seasonal high water table.	Slight	Moderate: seasonal high water table.	Slight.
Severe: seasonal high water table.	Moderate: seasonal high water table.[2]	Severe: very slow permeability.	Severe: very slow permeability; seasonal high water table.	Moderate: seasonal high water table.	Severe: very slow permeability; seasonal high water table.	Moderate: seasonal high water table.
Severe: seasonal high water table.	Moderate: seasonal high water table.[2]	Severe: very slow permeability.	Severe: very slow permeability; seasonal high water table.	Moderate: seasonal high water table.	Severe: very slow permeability; seasonal high water table.	Moderate: seasonal high water table.

TABLE—7. *Degree and kind of limitations of the*

Soil series and map symbols	Cultivated crops	Septic tank absorption fields	Sewage lagoons	Dwellings		Local roads and streets
				With basement	Without basement	
Edenton:						
EbC2	Moderate: slope; erosion.	Severe: moderately slow permeability; depth to bedrock.	Severe: slope; depth to bedrock.	Severe: depth to bedrock; low strength.	Severe: low strength.	Severe: low strength.
EbD2	Severe: slope; erosion.	Severe: slope; depth to bedrock.	Severe: slope; depth to bedrock.	Severe: slope; depth to bedrock; low strength.	Severe: slope; low strength.	Severe: slope; low strength.
EbF2	Severe: slope; erosion.	Severe: depth to bedrock; slope.	Severe: slope; depth to bedrock.	Severe: depth to bedrock; low strength; slope.	Severe: low strength; slope.	Severe: low strength; slope.
Eel: Ee	Slight	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding; subject to frost action.
Fitchville: FcA, FcB	Slight	Severe: moderately slow permeability; seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Severe: subject to frost action.
Fox:						
FlC2	Moderate: slope; erosion.	Moderate: slope.[2]	Severe: slope; high seepage rate.[2]	Moderate: slope.	Moderate: slope.	Moderate: slope.
FlD2	Severe: slope; erosion.	Severe: slope.[2]	Severe: high seepage rate; slope.[2]	Severe: slope.	Severe: slope.	Severe: slope.
FnA	Slight	Slight.[2]	Severe: high seepage rate.[2]	Slight	Slight	Slight
FnB	Slight	Slight.[2]	Severe: high seepage rate.[2]	Slight	Slight	Slight
FoC3	Severe: slope; erosion.	Moderate: slope.[2]	Severe: high seepage rate; slope.[2]	Moderate: slope.	Moderate: slope.	Moderate: slope.
Gasconade:						
GaC	Severe: slope; erosion; shallow to bedrock.	Severe: shallow to bedrock.[2]	Severe: shallow to bedrock; slope.[2]	Severe: shallow to bedrock.	Severe: shallow to bedrock.	Severe: shallow to bedrock.
GaD2	Severe: slope; erosion; shallow to bedrock.	Severe: shallow to bedrock; slope.[2]	Severe: shallow to bedrock; slope.[2]	Severe: shallow to bedrock; slope.	Severe: shallow to bedrock; slope.	Severe: shallow to bedrock; slope.
GbF2, GbG	Severe: slope; erosion; shallow to bedrock.	Severe: shallow to bedrock; slope.[2]	Severe: shallow to bedrock; slope.[2]	Severe: shallow to bedrock; slope.	Severe: shallow to bedrock; slope.	Severe: shallow to bedrock; slope.
Genesee: Gn	Slight	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.

See footnotes at end of table.

soils for town and country development—Continued

Shallow excavations	Sanitary landfill (trench) [1]	Lawns, landscaping, and golf fairways	Playgrounds	Picnic areas	Camp areas	Paths and trails
Severe: clayey layers.	Severe: depth to bedrock; clayey layers.	Moderate: depth to bedrock.	Severe: slope.	Moderate: slope.	Moderate: slope; moderately slow permeability.	Slight.
Severe: slope; clayey layers.	Severe: depth to bedrock; clayey layers.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Severe: clayey layers; slope.	Severe: depth to bedrock; clayey layers; slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Severe: subject to flooding	Severe: subject to flooding.	Moderate: subject to flooding.	Moderate: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Slight.
Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: moderately slow permeability; seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high water table.
Moderate: slope; gravelly subsoil.	Severe: permeable substratum.[2]	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Slight.
Severe: slope.	Severe: permeable substratum; slope.[2]	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Moderate: gravelly subsoil.	Severe: permeable substratum.[2]	Slight.	Slight.	Slight.	Slight.	Slight.
Moderate: gravelly subsoil.	Severe: permeable substratum.[2]	Slight.	Moderate: slope.	Slight.	Slight.	Slight.
Moderate: slope; gravelly subsoil.	Severe: permeable substratum.[2]	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Slight.
Severe: shallow to bedrock.	Severe: shallow to bedrock.	Severe: shallow to bedrock.	Severe: shallow to bedrock; slope.	Moderate: limestone fragments on surface.	Moderate: limestone fragments on surface.	Moderate: limestone fragments on surface.
Severe: shallow to bedrock; slope.	Severe: shallow to bedrock.[2]	Severe: shallow to bedrock; slope.	Severe: shallow to bedrock; slope.	Severe: slope.	Severe: slope.	Moderate: limestone fragments on surface.
Severe: shallow to bedrock; slope.	Severe: shallow to bedrock; slope.[2]	Severe: shallow to bedrock; slope.	Severe: shallow to bedrock; slope.	Severe: slope.	Severe: slope.	Severe: slope.
Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.

TABLE 7.—*Degree and kind of limitations of the*

Soil series and map symbols	Cultivated crops	Septic tank absorption fields	Sewage lagoons	Dwellings		Local roads and streets
				With basement	Without basement	
Guernsey:						
GuB	Slight	Severe: slow permeability.	Moderate: slope.	Severe: clayey subsoil; low strength.	Severe: clayey subsoil; low strength.	Severe: clayey subsoil; low strength.
GuC	Moderate: slope; erosion.	Severe: slow permeability.	Severe: slope	Severe: clayey subsoil; low strength.	Severe: clayey subsoil; low strength.	Severe: clayey subsoil; low strength.
GvC3	Severe: slope; erosion.	Severe: slow permeability.	Severe: slope	Severe: clayey subsoil; low strength.	Severe: clayey subsoil; low strength.	Severe: clayey subsoil; low strength.
GxD3	Severe: slope; erosion.	Severe: slow permeability; slope.	Severe: slope	Severe: clayey subsoil; low strength; slope.	Severe: clayey subsoil; low strength; slope.	Severe: clayey subsoil; low strength; slope.
Haubstadt:						
HbA	Slight	Severe: slow permeability.	Moderate: moderate permeability below a depth of 53 inches.	Moderate: seasonal high water table.	Slight	Moderate: subject to frost action.
HbB, HcB Urban land part of HcB is too variable to be rated.	Slight	Severe: slow permeability.	Moderate: moderate permeability below a depth of 53 inches; slope.	Moderate: seasonal high water table.	Slight	Moderate: subject to frost action.
HbC2, HcC Urban land part of HcC is too variable to be rated.	Moderate: slope; erosion.	Severe: slow permeability.	Severe: slope	Moderate: seasonal high water table; slope.	Moderate: slope.	Moderate: subject to frost action; slope.
HbC3	Severe: slope; erosion.	Severe: slow permeability.	Severe: slope	Moderate: seasonal high water table; slope.	Moderate: slope.	Moderate: subject to frost action; slope.
HbD2, HbD3	Severe: slope; erosion.	Severe: slow permeability; slope.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Hennepin: Ratings are for both Hennepin and Miamian soils.						
HeF2, HeG2	Severe: slope; erosion.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
HfE3	Severe: slope; erosion.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.

See footnotes at end of table.

soils for town and country development—Continued

Shallow excavations	Sanitary landfill (trench) [1]	Lawns, landscaping, and golf fairways	Playgrounds	Picnic areas	Camp areas	Paths and trails
Moderate: moderately well drained.	Severe: clayey layers; hard to pack.	Severe: slow permeability.	Moderate: slope; slow permeability.	Slight	Moderate: slow permeability; moderately well drained.	Slight.
Moderate: moderately well drained; slope.	Severe: clayey layers; hard to pack.	Severe: slow permeability.	Severe: slope	Moderate: slope.	Moderate: slow permeability; moderately well drained.	Slight.
Moderate: moderately well drained; slope.	Severe: clayey layers; hard to pack.	Severe: slow permeability.	Severe: slope	Moderate: slope.	Moderate: slow permeability; moderately well drained; slope.	Slight.
Severe: slope	Severe: clayey layers; hard to pack.	Severe: slow permeability; slope.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Moderate: seasonal high water table.	Slight	Severe: slow permeability.	Moderate: slow permeability; seasonal high water table.	Slight	Moderate: slow permeability; seasonal high water table.	Slight.
Moderate: seasonal high water table.	Slight	Severe: slow permeability.	Moderate: slow permeability; seasonal high water table; slope.	Slight	Moderate: slow permeability; seasonal high water table.	Slight.
Moderate: seasonal high water table; slope.	Slight	Severe: slow permeability.	Severe: slope	Moderate: slope.	Moderate: slow permeability; seasonal high water table; slope.	Slight.
Moderate: seasonal high water table; slope.	Slight	Severe: slow permeability.	Severe: slope	Moderate: slope.	Moderate: slow permeability; seasonal high water table; slope.	Slight.
Severe: slope	Moderate: slope.	Severe: slow permeability; slope.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: slope	Moderate: slope.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.

TABLE 7.—*Degree and kind of limitations of the*

Soil series and map symbols	Cultivated crops	Septic tank absorption fields	Sewage lagoons	Dwellings		Local roads and street
				With basement	Without basement	
Hickory:						
HkC2	Moderate: slope; erosion.	Moderate: moderate permeability; slope.	Severe: slope	Moderate: slope; seasonal high water table.	Moderate: slope.	Severe: subject to frost action.
HkD2, HkE2, HyD3, HyE3.	Severe: slope; erosion.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: subject to frost action; slope.
HkF2	Severe: very steep slopes.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope
HyC3	Severe: slope; erosion.	Moderate: moderate permeability; slope.	Severe: slope	Moderate: slope; seasonal high water table.	Moderate: slope.	Severe: subject to frost action.
Jessup: JeD	Severe: slope; erosion.	Severe: slow permeability; slope.	Severe: slope	Severe: slope; low strength.	Severe: slope; low strength.	Severe: slope; low strength.
Johnsburg: JoC	Slight	Severe: very slow permeability.	Moderate: slope; depth to bedrock.	Severe: seasonal high water table.	Moderate: seasonal high water table; slope.	Severe: subject to frost action.
Kendallville:						
KeB	Slight	Severe: moderately slow permeability.	Moderate: slope.	Slight	Slight	Moderate: moderate shrink-swell potential.
KeC2	Moderate: slope; erosion.	Severe: moderately slow permeability.	Severe: slope	Moderate: slope.	Moderate: slope.	Moderate: moderate shrink-swell potential; slope.
KeD2, KfD3	Severe: slope; erosion.	Severe: moderately slow permeability; slope.	Severe: slope	Severe: slope	Severe: slope	Severe: slope
Lawshe:						
LhB	Moderate: slope; erosion.	Severe: very slow permeability.	Moderate: depth to bedrock; slope.	Severe: depth to bedrock; low strength.	Severe: low strength.	Severe: low strength; high shrink-swell potential.
LhC2	Severe: slope; erosion.	Severe: very slow permeability.	Severe: slope	Severe: depth to bedrock; low strength.	Severe: low strength.	Severe: low strength; high shrink-swell potential.
LhD2, LlD3	Severe: slope; erosion.	Severe: very slow permeability; slope.	Severe: slope	Severe: depth to bedrock; low strength; slope.	Severe: low strength; slope.	Severe: low strength; high shrink-swell potential; slope.
Loudon:						
LoB, LoB2	Slight	Severe: slow permeability.	Moderate: slope.	Severe: low strength.	Severe: low strength.	Severe: low strength.
LoC2	Moderate: slope; erosion.	Severe: slow permeability.	Severe: slope	Severe: low strength.	Severe: low strength.	Severe: low strength.
LoD2, LpE2 For Edenton part of LpE2, see EbD2 in Edenton series.	Severe: slope; erosion.	Severe: slow permeability; slope.	Severe: slope	Severe: low strength; slope.	Severe: low strength; slope.	Severe: low strength; slope.

See footnotes at end of table.

soils for town and country development—Continued

Shallow excavations	Sanitary landfill (trench) [1]	Lawns, landscaping, and golf fairways	Playgrounds	Picnic areas	Camp areas	Paths and trails
Moderate: slope.	Moderate: slightly sticky.	Moderate: slope.	Severe: slope	Moderate: slope.	Moderate: slope.	Slight.
Severe: slope	Moderate: slightly sticky; slope.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Moderate: slope.	Moderate: slightly sticky.	Moderate: slope.	Severe: slope	Moderate: slope.	Moderate: slope.	Slight.
Severe: slope; clayey subsoil.	Severe: clayey layers.	Severe: slow permeability; slope.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Severe: seasonal high water table.	Moderate: seasonal high water table.	Severe: very slow permeability.	Severe: very slow permeability.	Moderate: seasonal high water table.	Severe: very slow permeability.	Moderate: seasonal high water table.
Slight	Slight	Moderate: moderately slow permeability.	Moderate: moderately slow permeability; slope.	Slight	Moderate: moderately slow permeability.	Slight.
Moderate: slope.	Slight	Moderate: moderately slow permeability; slope.	Severe: slope	Moderate: slope.	Moderate: moderately slow permeability; slope.	Slight.
Severe: slope	Moderate: slope.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Severe: clayey subsoil.	Severe: clayey material; depth to bedrock.	Severe: very slow permeability.	Severe: very slow permeability; clayey layers.	Severe: clayey layers.	Severe: very slow permeability; clayey layers.	Severe: clayey layers.
Severe: clayey subsoil.	Severe: clayey material; depth to bedrock.	Severe: very slow permeability.	Severe: very slow permeability; clayey layers; slope.	Severe: clayey layers.	Severe: very slow permeability; clayey layers.	Severe: clayey layers.
Severe: clayey subsoil; slope.	Severe: clayey material; depth to bedrock.	Severe: very slow permeability; slope.	Severe: very slow permeability; clayey layers; slope.	Severe: clayey layers; slope.	Severe: very slow permeability; clayey layers; slope.	Severe: clayey layers.
Severe: clayey subsoil.	Severe: clayey material.	Severe: slow permeability.	Moderate: slow permeability; slope.	Slight	Moderate: slow permeability.	Slight.
Severe: clayey subsoil.	Severe: clayey material.	Severe: slow permeability.	Severe: slope	Moderate: slope.	Moderate: slow permeability; slope.	Slight.
Severe: clayey subsoil; slope.	Severe: clayey material.	Severe: slope; slow permeability.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.

TABLE 7.—*Degree and kind of limitations of the*

Soil series and map symbols	Cultivated crops	Septic tank absorption fields	Sewage lagoons	Dwellings		Local roads and streets
				With basement	Without basement	
Markland:						
MdB	Moderate: slope; erosion.	Severe: slow permeability.	Moderate: slope.	Moderate: low strength; seasonal high water table.	Moderate: low strength.	Severe: clayey subsoil; low strength.
MdC2	Severe: slope; erosion.	Severe: slow permeability.	Severe: slope	Moderate: low strength; seasonal high water table; slope.	Moderate: low strength; slope.	Severe: clayey subsoil; low strength.
MdD2	Severe: slope; erosion.	Severe: slow permeability; slope.	Severe: slope	Severe: slope	Severe: slope	Severe: clayey subsoil; low strength; slope.
McGary: MgB	Moderate: wetness.	Severe: slow permeability; seasonal high water table.	Moderate: slope.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Severe: clayey subsoil; low strength.
Miamian:						
MlB, MlB2, MrB, MrB2, MsB. For Russell part of MrB and MrB2, see Russell series. Urban land part of MsB is too variable to be rated.	Slight	Severe: moderately slow permeability.	Moderate: slope.	Moderate: shrink-swell potential.	Moderate: shrink-swell potential.	Severe: clayey subsoil; low strength.
MlC2, MrC2.						
Miamian part	Moderate: slope; erosion.	Severe: moderately slow permeability.	Severe: slope	Moderate: shrink-swell potential; slope.	Moderate: shrink-swell potential; slope.	Severe: clayey subsoil; low strength.
Russell part of MrC2.	Moderate: slope; erosion.	Moderate: moderate permeability; slope.	Severe: slope	Moderate: slope.	Moderate: slope.	Moderate: slope; moderate frost action; high silt content.
MlD2, MlE	Severe: slope; erosion.	Severe: moderately slow permeability; slope.	Severe: slope	Severe: slope	Severe: slope	Severe: clayey subsoil; low strength; slope.
MmC3	Severe: slope; erosion.	Severe: moderately slow permeability.	Severe: slope	Moderate: shrink-swell potential; slope.	Moderate: shrink-swell potential; slope.	Severe: clayey subsoil; low strength.
Millsdale: Mt	Moderate: wetness.	Severe: high water table; moderately slow permeability; limited depth to bedrock. [2]	Severe: high water table; limited depth to bedrock. [2]	Severe: high water table; limited depth to bedrock. [2]	Severe: high water table.	Severe: high water table; low strength.

See footnotes at end of table.

soils for town and country development—Continued

Shallow excavations	Sanitary landfill (trench) [1]	Lawns, landscaping, and golf fairways	Playgrounds	Picnic areas	Camp areas	Paths and trails
Severe: clayey subsoil.	Severe: clayey material.	Severe: slow permeability.	Moderate: slow permeability; slope.	Slight	Moderate: slow permeability.	Slight.
Severe: clayey subsoil.	Severe: clayey material.	Severe: slow permeability.	Severe: slope	Moderate: slope.	Moderate: slope; slow permeability.	Slight.
Severe: clayey subsoil; slope.	Severe: clayey material.	Severe: slow permeability; slope.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Severe: clayey subsoil; seasonal high water table.	Severe: clayey material.	Severe: slow permeability.	Severe: seasonal high water table; slow permeability.	Moderate: seasonal high water table.	Severe: seasonal high water table; slow permeability.	Moderate: seasonal high water table.
Slight	Slight	Moderate: moderately slow permeability.	Moderate: moderately slow permeability; slope.	Slight	Moderate: moderately slow permeability.	Slight.
Moderate: slope.	Slight	Moderate: moderately slow permeability; slope.	Severe: slope	Moderate: slope.	Moderate: moderately slow permeability; slope.	Slight.
Moderate: slope.	Slight	Moderate: slope.	Severe: slope	Moderate: slope.	Moderate: slope.	Slight.
Severe: slope	Moderate: slope.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Moderate: slope.	Slight	Moderate: moderately slow permeability; slope.	Severe: slope	Moderate: slope.	Moderate: moderately slow permeability; slope.	Moderate: clay loam surface layer.
Severe: high water table; limited depth to bedrock.	Severe: high water table; limited depth to bedrock.[2]	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.

TABLE 7.—*Degree and kind of limitations of the*

Soil series and map symbols	Cultivated crops	Septic tank absorption fields	Sewage lagoons	Dwellings		Local roads and streets
				With basement	Without basement	
Milton:						
MuB, MuB2	Slight	Severe: limited depth to bedrock; moderately slow permeability.[2]	Severe: limited depth to bedrock.[2]	Severe: limited depth to bedrock.	Severe: low strength.	Severe: low strength.
MuC2	Moderate: slope; erosion.	Severe: limited depth to bedrock; moderately slow permeability.[2]	Severe: limited depth to bedrock.[2]	Severe: limited depth to bedrock.	Severe: low strength.	Severe: low strength.
MuD2	Severe: slope; erosion.	Severe: limited depth to bedrock; moderately slow permeability; slope.[2]	Severe: limited depth to bedrock; slope.[2]	Severe: limited depth to bedrock; slope.	Severe: low strength; slope.	Severe: low strength; slope.
MwC3	Moderate: slope; erosion.	Severe: limited depth to bedrock; moderately slow permeability.[2]	Severe: limited depth to bedrock.[2]	Severe: limited depth to bedrock.	Severe: low strength.	Severe: low strength.
Montgomery: My	Moderate: wetness.	Severe: high water table; very slow permeability.	Slight	Severe: high water table.	Severe: high water table.	Severe: high water table.
Negley:						
NdC	Moderate: slope; erosion.	Moderate: slope.[2]	Severe: slope; moderately rapid permeability.[2]	Moderate: slope.	Moderate: slope.	Moderate: slope.
NdD, NdE, NfD3	Severe: slope; erosion.	Severe: slope.[2]	Severe: slope; moderately rapid permeability.[2]	Severe: slope	Severe: slope	Severe: slope
NdF, NgF Ratings are for both Negley and Fox soils in NgF.	Severe: slope; erosion.	Severe: slope.[2]	Severe: slope; moderately rapid permeability.[2]	Severe: slope	Severe: slope	Severe: slope
NeB	Slight	Slight[2]	Severe: moderately rapid permeability.[2]	Slight	Slight	Slight
NfC3	Severe: slope; erosion.	Moderate: slope.[2]	Severe: slope; moderately rapid permeability.[2]	Moderate: slope.	Moderate: slope.	Moderate: slope.
Nicholson:						
NnB, NnB2	Slight	Severe: slow permeability.	Moderate: slope; depth to bedrock.	Moderate: depth to bedrock; seasonal high water table.	Moderate: low strength in lower subsoil.	Moderate: frost action; shrink-swell potential.
NnC2	Moderate: slope; erosion.	Severe: slow permeability.	Severe: slope	Moderate: depth to bedrock; seasonal high water table; slope.	Moderate: low strength in lower subsoil; slope.	Moderate: frost action; shrink-swell potential; slope.

See footnotes at end of table.

soils for town and country development—Continued

Shallow excavations	Sanitary landfill (trench) [1]	Lawns, landscaping, and golf fairways	Playgrounds	Picnic areas	Camp areas	Paths and trails
Severe: limited depth to bedrock.	Svere: limited depth to bedrock.[2]	Moderate: limited depth to bedrock.	Moderate: limited depth to bedrock; moderately slow permeability; slope.	Slight	Moderate: moderately slow permeability.	Slight.
Severe: limited depth to bedrock.	Severe: limited depth to bedrock.[2]	Moderate: limited depth to bedrock; slope.	Severe: slope	Moderate: slope	Moderate: moderately slow permeability; slope.	Slight.
Severe: limited depth to bedrock; slope.	Severe: limited depth to bedrock.[2]	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Severe: limited depth to bedrock.	Severe: limited depth to bedrock.[2]	Moderate: limited depth to bedrock; slope.	Severe: slope	Moderate: slope; clay loam surface layer.	Moderate: slope; moderately slow permeability.	Moderate: clay loam surface layer.
Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Moderate: slope; gravelly layers.	Severe: moderately rapid permeability.[2]	Moderate: slope; droughty.	Severe: slope	Moderate: slope.	Moderate: slope.	Slight.
Severe: slope	Severe: moderately rapid permeability.[2]	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Severe: slope	Severe: moderately rapid permeability; slope.[2]	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Moderate: gravelly layers.	Severe: moderately rapid permeability.[2]	Moderate: droughty.	Moderate: slope; gravelly surface layer.	Slight	Slight	Slight.
Moderate: slope; gravelly layers.	Severe: moderately rapid permeability.[2]	Moderate: slope; droughty.	Severe: slope	Moderate: slope; clay loam surface layer.	Moderate: slope; clay loam surface layer.	Moderate: clay loam surface layer.
Moderate: depth to bedrock; seasonal high water table.	Severe: depth to bedrock.	Severe: slow permeability.	Moderate: slow permeability; slope.	Slight	Moderate: slow permeability.	Slight.
Moderate: depth to bedrock; seasonal high water table; slope.	Severe: depth to bedrock.	Severe: slow permeability.	Severe: slope	Moderate: slope.	Moderate: slow permeability; slope.	Slight.

TABLE 7.—*Degree and kind of limitations of the*

Soil series and map symbols	Cultivated crops	Septic tank absorption fields	Sewage lagoons	Dwellings		Local roads and streets
				With basement	Without basement	
Ockley:						
OcA	Slight	Slight [2]	Moderate: moderate permeability.[2]	Slight	Slight	Moderate: silty upper part of subsoil.
OcB, OdB Urban land part of OdB is too variable to be rated.	Slight	Slight [2]	Moderate: moderate permeability; slope.[2]	Slight	Slight	Moderate: silty upper part of subsoil.
OcC2	Moderate: slope; erosion.	Moderate: slope.[2]	Severe: slope [2]	Moderate: slope.	Moderate: slope.	Moderate: slope; silty upper subsoil layers.
Opequon:						
OpD2	Severe: slope; erosion.	Severe: shallow to bedrock.[2]	Severe: slope; shallow to bedrock.[2]	Severe: shallow to bedrock.	Severe: shallow to bedrock.	Severe: shallow to bedrock; clayey subsoil layers.
OpE2	Severe: slope; erosion.	Severe: shallow to bedrock; slope.[2]	Severe: slope; shallow to bedrock.[2]	Severe: shallow to bedrock; slope.	Severe: shallow to bedrock; slope.	Severe: shallow to bedrock; clayey subsoil layers; slope.
OsF2, OsG	Severe: slope; stoniness.	Severe: shallow to bedrock; stoniness; slope.[2]	Severe: slope; shallow to bedrock; stoniness.[2]	Severe: shallow to bedrock; stoniness; slope.	Severe: shallow to bedrock; stoniness; slope.	Severe: shallow to bedrock; clayey subsoil layers; slope.
OtD3	Severe: slope; erosion.	Severe: shallow to bedrock.[2]	Severe: slope; shallow to bedrock.[2]	Severe: shallow to bedrock.	Severe: shallow to bedrock.	Severe: shallow to bedrock; clayey subsoil layers.
Otwell:						
OwB	Slight	Severe: very slow permeability.[2]	Moderate: slope.[2]	Slight	Slight	Moderate: silty upper soil layers.
OwC2	Moderate: slope; erosion.	Severe: very slow permeability.[2]	Severe: slope.[2]	Moderate: slope.	Moderate: slope.	Moderate: silty upper soil layers; slope.
OwD2, OwE2	Severe: slope; erosion.	Severe: very slow permeability; slope.[2]	Severe: slope.[2]	Severe: slope	Severe: slope	Severe: slope
OwF	Severe: slope; erosion.	Severe: very slow permeability; slope.[2]	Severe: slope.[2]	Severe: slope	Severe: slope	Severe: slope
Patton: Pa, Pb	Slight	Severe: slow permeability; high water table.	Slight	Severe: high water table.	Severe: high water table.	Severe: high water table; subject to frost action.
Peoga: Pe	Moderate: wetness.	Severe: slow permeability; high water table.	Slight	Severe: high water table.	Severe: high water table.	Severe: high water table; subject to frost action.
Philo: Pn	Slight	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding; high frost action.

See footnotes at end of table.

soils for town and country development—Continued

Shallow excavations	Sanitary landfill (trench) [1]	Lawns, landscaping, and golf fairways	Playgrounds	Picnic areas	Camp areas	Paths and trails
Slight	Severe: rapid permeability in substratum.[2]	Slight	Slight	Slight	Slight	Slight.
Slight	Severe: rapid permeability in substratum.[2]	Slight	Moderate: slope.	Slight	Slight	Slight.
Slight	Severe: rapid permeability in substratum.[2]	Moderate: slope.	Severe: slope	Moderate: slope.	Moderate: slope.	Slight.
Severe: shallow to bedrock.	Severe: shallow to bedrock.[2]	Severe: shallow to bedrock.	Severe: slope; shallow to bedrock.	Moderate: slope.	Moderate: slope.	Slight.
Severe: shallow to bedrock; slope.	Severe: shallow to bedrock.[2]	Severe: shallow to bedrock; slope.	Severe: slope; shallow to bedrock.	Severe: slope	Severe: slope	Moderate: slope.
Severe: shallow to bedrock; stoniness; slope.	Severe: slope; shallow to bedrock; stoniness.[2]	Severe: shallow to bedrock; stoniness; slope.	Severe: slope; shallow to bedrock; stoniness.	Severe: slope	Severe: slope; stoniness.	Severe: slope; stoniness.
Severe: shallow to bedrock.	Severe: shallow to bedrock.[2]	Severe: shallow to bedrock; clay surface layer.	Severe: slope; shallow to bedrock; clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Slight	Severe: permeable substratum.[2]	Severe: very slow permeability.	Severe: very slow permeability.	Slight	Severe: very slow permeability.	Slight.
Moderate: slope.	Severe: permeable substratum.[2]	Severe: very slow permeability.	Severe: very slow permeability; slope.	Moderate: slope.	Severe: very slow permeability.	Slight.
Severe: slope	Severe: permeable substratum.[2]	Severe: very slow permeability; slope.	Severe: very slow permeability; slope.	Severe: slope	Severe: very slow permeability.	Moderate: slope.
Severe: slope	Severe: permeable substratum; slope.[2]	Severe: very slow permeability; slope.	Severe: very slow permeability; slope.	Severe: slope	Severe: very slow permeability; slope.	Severe: slope.
Severe: high water table.	Severe: high water table.	Severe: slow permeability; high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Severe: high water table.	Severe: high water table.	Severe: slow permeability; high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Slight.

TABLE 7.—*Degree and kind of limitations of the*

Soil series and map symbols	Cultivated crops	Septic tank absorption fields	Sewage lagoons	Dwellings		Local roads and streets
				With basement	Without basement	
Ross: Rn	Slight	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding; high frost action.
Rossmoyne: RpA	Slight	Severe: slow permeability.	Slight	Moderate: seasonal wetness.	Slight	Moderate: high silt content; moderate frost action.
RpB, RpB2, RtB Urban land part of RtB is too variable to be rated.	Slight	Severe: slow permeability.	Moderate: slope.	Moderate: seasonal wetness.	Slight	Moderate: high silt content; moderate frost action.
RpC2	Moderate: slope; erosion.	Severe: slow permeability.	Severe: slope	Moderate: seasonal wetness; slope.	Moderate: slope.	Moderate: high silt content; moderate frost action; slope.
RpD2	Severe: slope; erosion.	Severe: slow permeability; slope.	Severe: slope	Severe: slope	Severe: slope	Severe: slope
RsC3	Severe: slope; erosion.	Severe: slow permeability.	Severe: slope	Moderate: seasonal wetness; slope.	Moderate: slope.	Moderate: high silt content; moderate frost action; slope.
Russell: RuB	Slight	Moderate: moderate permeability.	Moderate: moderate permeability; slope.	Slight	Slight	Moderate: moderate frost action; high silt content.
Sardinia: SaA	Slight	Moderate: moderate permeability.[2]	Moderate: moderate permeability.[2]	Moderate: seasonal wetness.	Slight	Moderate: moderate frost action.
SaB	Slight	Moderate: moderate permeability.[2]	Moderate: moderate permeability; slope.[2]	Moderate: seasonal wetness.	Slight	Moderate: moderate frost action.
SaC2	Moderate: slope; erosion.	Moderate: moderate permeability; slope.[2]	Severe: slope.[2]	Moderate: seasonal wetness; slope.	Moderate: slope.	Moderate: moderate frost action; slope.
Shoals: Sh	Slight	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding; seasonal high water table.	Severe: subject to flooding.	Severe: subject to flooding; seasonal high water table.
Sleeth: SlA	Slight	Severe: seasonal high water table.[2]	Severe: permeable substratum.[2]	Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table; moderate to high frost action.
Sloan: Sn	Moderate: wetness.	Severe: subject to flooding; high water table.	Severe: subject to flooding; high water table.	Severe: subject to flooding; high water table.	Severe: subject to flooding; high water table.	Severe: subject to flooding; high water table; high frost action.

See footnotes at end of table.

soils for town and country development—Continued

Shallow excavations	Sanitary landfill (trench) [1]	Lawns, landscaping, and golf fairways	Playgrounds	Picnic areas	Camp areas	Paths and trails
Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Moderate: subject to flooding.	Moderate: subject to flooding.[2]	Severe: subject to flooding.	Slight.
Moderate: seasonal wetness.	Moderate: high clay content in subsoil; seasonal wetness.	Moderate: slow permeability.	Moderate: slow permeability; seasonal wetness.	Slight	Moderate: slow permeability; seasonal wetness.	Slight.
Moderate: seasonal wetness.	Moderate: high clay content in subsoil; seasonal wetness.	Moderate: slow permeability.	Moderate: slow permeability; seasonal wetness; slope.	Slight	Moderate: slow permeability; seasonal wetness.	Slight.
Moderate: seasonal wetness; slope.	Moderate: high clay content in subsoil; seasonal wetness.	Moderate: slow permeability; slope.	Severe: slope	Moderate: slope.	Moderate: slow permeability; seasonal wetness.	Slight.
Severe: slope	Moderate: high clay content in subsoil; seasonal wetness; slope.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Moderate: seasonal wetness; slope.	Moderate: high clay content in subsoil; seasonal wetness.	Moderate: slow permeability; silty clay loam surface layer; slope.	Severe: slope	Moderate: slope; silty clay loam surface layer.	Moderate: slow permeability; seasonal wetness.	Moderate: silty clay loam surface layer.
Slight	Slight	Slight	Moderate: slope.	Slight	Slight	Slight.
Moderate: seasonal wetness.	Severe: permeable substratum.[2]	Slight	Moderate: seasonal wetness.	Slight	Moderate: seasonal wetness.	Slight.
Moderate: seasonal wetness.	Severe: permeable substratum.[2]	Slight	Moderate: seasonal wetness; slope.	Slight	Moderate: seasonal wetness.	Slight.
Moderate: seasonal wetness; slope.	Severe: permeable substratum.[2]	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: seasonal wetness.	Slight.
Severe: subject to flooding; seasonal high water table.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding; seasonal high water table.	Moderate: subject to flooding; seasonal high water table.	Severe: subject to flooding; seasonal high water table.	Moderate: seasonal high water table.
Severe: seasonal high water table.	Severe: permeable substratum.[2]	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.
Severe: high water table; subject to flooding.	Severe: subject to flooding; high water table.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.	Severe: high water table.	Severe: high water table; subject to flooding.	Severe: high water table.

TABLE 7.—*Degree and kind of limitations of the*

Soil series and map symbols	Cultivated crops	Septic tank absorption fields	Sewage lagoons	Dwellings		Local roads and street
				With basement	Without basement	
Stonelick: St	Slight	Severe: subject to flooding.	Severe: moderately rapid permeability; subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Thackery:						
ThA	Slight	Moderate: moderate permeability.[2]	Severe: permeable substratum.[2]	Moderate: seasonal wetness.	Slight	Moderate: moderate frost action.
ThB	Slight	Moderate: moderate permeability.[2]	Severe: permeable substratum.[2]	Moderate: seasonal wetness.	Slight	Moderate: moderate frost action.
Trappist:						
TrE, TsD2.						
Trappist part	Severe: slope; erosion.	Severe: slope; slow permeability; depth to bedrock.	Severe: slope; depth to bedrock.	Severe: slope; depth to bedrock.	Severe: slope	Severe: slope; low strength.
Muse part of TsD2	Severe: slope; erosion.	Severe: slope; slow permeability.	Severe: slope	Severe: slope	Severe: slope	Severe: slope; low strength.
TsB.						
Trappist part	Slight	Severe: slow permeability; depth to bedrock.	Severe: depth to bedrock.	Severe: depth to bedrock.	Moderate: depth to bedrock; low strength.	Severe: clayey subsoil layers; low strength.
Muse part	Slight	Severe: slow permeability.	Moderate: slope.	Moderate: depth to bedrock; low strength.	Moderate: low strength.	Severe: clayey subsoil layers; low strength.
TsC2.						
Trappist part	Moderate: slope; erosion.	Severe: slow permeability; depth to bedrock.	Severe: slope; depth to bedrock.	Severe: depth to bedrock.	Moderate: slope; depth to bedrock; low strength.	Severe: clayey subsoil layers; low strength.
Muse part	Moderate: slope; erosion.	Severe: slow permeability.	Severe: slope	Moderate: slope; depth to bedrock; low strength.	Moderate: slope; low strength.	Severe: clayey layers; low strength.
Tuscarawas:						
TuD	Severe: slope; erosion.	Severe: slow permeability.	Severe: slope.	Moderate: slope; depth to bedrock; low strength; seasonal wetness.	Moderate: slope; low strength.	Severe: highly susceptible to frost action; low strength.
TuF	Severe: slope; erosion.	Severe: slow permeability; slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: highly susceptible to frost action; low strength; slope.
Warsaw: WaA	Slight	Slight [2]	Severe: permeable substratum.[2]	Slight	Slight	Moderate: moderate shrink-swell potential in subsoil.

See footnotes at end of table.

soils for town and country development—Continued

Shallow excavations	Sanitary landfill (trench) [1]	Lawns, landscaping, and golf fairways	Playgrounds	Picnic areas	Camp areas	Paths and trails
Severe: subject to flooding.	Severe: moderately rapid permeability; subject to flooding.	Moderate: subject to flooding.	Moderate: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Slight.
Moderate: seasonal wetness.	Severe: permeable substratum.[2]	Slight	Moderate: seasonal wetness.	Slight	Moderate: seasonal wetness.	Sllght.
Moderate: seasonal wetness.	Severe: permeable substratum.[2]	Slight	Moderate: seasonal wetness; slope.	Slight	Moderate: seasonal wetness.	Slight.
Severe: slope; depth to bedrock.	Severe: depth to bedrock; clayey layers.	Severe: slope; slow permeability.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Severe: slope	Severe: depth to bedrock; clayey layers.	Severe: slope; slow permeability.	Severe: slope	Moderate: slope.	Moderate: slope; slow permeability.	Slight.
Severe: depth to bedrock.	Severe: depth to bedrock; clayey layers.	Severe: slow permeability.	Moderate: slow permeability; depth to bedrock; slope.	Slight	Moderate: slow permeability.	Slight.
Moderate: depth to bedrock.	Severe: depth to bedrock; clayey layers.	Severe: slow permeability.	Moderate: slow permeability; slope.	Slight	Moderate: slow permeability.	Slight.
Severe: depth to bedrock.	Severe: depth to bedrock; clayey layers.	Severe: slow permeability.	Severe: slope	Moderate: slope.	Moderate: slow permeability; slope.	Slight.
Moderate: depth to bedrock.	Severe: depth to bedrock; clayey layers.	Severe: slow permeability.	Severe: slope	Moderate: slope.	Moderate: slow permeability; slope.	Slight.
Moderate: slope; depth to bedrock; seasonal wetness.	Severe: depth to bedrock.	Severe: slow permeability.	Severe: slope	Moderate: slope.	Moderate: slope; slow permeability; seasonal wetness.	Slight.
Severe: slope	Severe: depth to bedrock; slope.	Severe: slow permeability; slope.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Moderate: gravelly layers.	Severe: permeable substratum.[2]	Moderate: droughty.	Slight	Slight	Slight	Slight.

TABLE 7.—*Degree and kind of limitations of the*

Soil series and map symbols	Cultivated crops	Septic tank absorption fields	Sewage lagoons	Dwellings		Local roads and streets
				With basement	Without basement	
Wea: WeA	Slight	Slight [2]	Severe: permeable substratum.[2]	Slight	Slight	Moderate: moderate shrink-swell potential in subsoil.
WeB	Slight	Slight [2]	Severe: permeable substratum.[2]	Slight	Slight	Moderate: moderate shrink-swell potential in subsoil.
Wellston: WIC	Moderate: slope; erosion.	Moderate: slope; depth to bedrock.	Severe: slope.	Moderate: slope; depth to bedrock.	Moderate: slope.	Moderate: moderately susceptible to frost action; slope.
WID	Severe: slope; erosion.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Westland: Ws, Wt	Slight	Severe: high water table; slow permeability.[2]	Severe: high water table; permeable substratum.[2]	Severe: high water table.	Severe: high water table.	Severe: high water table; highly susceptible to frost action.
Williamsburg: WvA	Slight	Slight [2]	Moderate: moderate permeability.[2]	Slight	Slight	Moderate: moderate strength in subsoil.
WvB	Slight	Slight [2]	Moderate: moderate permeability; slope.[2]	Slight	Slight	Moderate: moderate strength in subsoil.
WvC	Moderate: slope; erosion.	Moderate: slope.[2]	Severe: slope [2]	Moderate: slope.	Moderate: slope.	Moderate: moderate strength in subsoil; slope.
Xenia: XeB	Slight	Severe: moderately slow permeability.	Moderate: slope.	Moderate: seasonal wetness.	Slight	Moderate: moderate strength in subsoil.

[1] Onsite deep studies of the underlying strata, water table, and hazards of aquifer pollution and drainage into ground water need to be made for landfills more than 5 to 6 feet deep.

soils for town and country development—Continued

Shallow excavations	Sanitary landfill (trench) [1]	Lawns, landscaping, and golf fairways	Playgrounds	Picnic areas	Camp areas	Paths and trails
Moderate: gravelly layers.	Severe: permeable substratum.[2]	Slight	Slight	Slight	Slight	Slight.
Moderate: gravelly layers.	Severe: permeable substratum.[2]	Slight	Moderate: slope.	Slight	Slight	Slight.
Moderate: slope; depth to bedrock.	Severe: depth to bedrock.	Moderate: slope.	Severe: slope	Moderate: slope.	Moderate: slope.	Slight.
Severe: slope	Severe: depth to bedrock.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Severe: high water table.	Severe: high water table.[2]	Severe: slow permeability; high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Slight	Severe: substratum may be permeable.[2]	Slight	Slight	Slight	Slight	Slight.
Slight	Severe: substratum may be permeable.[2]	Slight	Moderate: slope.	Slight	Slight	Slight.
Moderate: slope.	Severe: substratum may be permeable.[2]	Moderate: slope.	Severe: slope	Moderate: slope.	Moderate: slope.	Slight.
Moderate: seasonal wetness.	Moderate: seasonal wetness; too clayey.	Moderate: moderately slow permeability.	Moderate: slope; moderately slow permeability; seasonal wetness.	Slight	Moderate: moderately slow permeability; seasonal wetness.	Slight.

[2] Pollutants can contaminate nearby wells, springs, lakes, or ponds, because filtration is not adequate.

Picnic areas.—Picnic and other extensive play areas can be located on many kinds of soils that have severe limitations for most other uses. Flood plains, for example, can be safely developed as extensive play areas. Many areas along streams are scenic and, because of their linear shape, can be used by a large number of people. Considered in rating these areas were the hazard of flooding, degree of stoniness and rockiness, degree of slope, texture of the surface soil, and depth to the water table.

Camp areas.—Sites for tents and trailers should be suitable for unsurfaced areas for cars and camping trailers. Properties to consider when selecting campsites are a hazard of flooding, seasonal high water table, permeability, slope, and soil texture. Wetness is the major factor that affects campsites. Soils that have a slope of less than 12 percent are the most desirable for use as tent campsites, but trailers need less sloping soils. Soils that have a medium-textured surface layer have fewer limitations than very clayey or very sandy soils.

Paths and trails.—Soil properties considered in rating the soils for this use are a seasonal high water table, flooding hazard, slope, surface soil texture, and rockiness or stoniness.

Descriptions of the Soils

This section describes the soil series and mapping units in Highland County. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. Color terms are for moist soil unless otherwise stated. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit.

Preceding the name of each mapping unit is a symbol. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit and woodland suitability group in which the mapping unit has been placed. The page for the description of each capability unit is listed in the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 8. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*14*).

TABLE 8.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent	Soil	Acres	Percent
Algiers silt loam	8,711	2.5	Boston-Bratton complex, 12 to 18 percent slopes, severely eroded	538	.1
Atlas silt loam, 2 to 6 percent slopes	220	.1	Boston-Bratton complex, 18 to 25 percent slopes, moderately eroded	952	.3
Atlas silt loam, 2 to 6 percent slopes, moderately eroded	1,217	.3	Boston-Grayford silt loams, 2 to 6 percent slopes	2,220	.6
Atlas silt loam, 6 to 12 percent slopes, moderately eroded	822	.2	Boston-Grayford silt loams, 2 to 6 percent slopes, moderately eroded	3,631	1.0
Atlas silt loam, 6 to 12 percent slopes, severely eroded	241	.1	Boston-Urban land complex, gently sloping	351	.1
Avonburg silt loam, 0 to 2 percent slopes	27,171	7.7	Boston-Urban land complex, sloping	402	.1
Avonburg silt loam, 2 to 6 percent slopes	6,197	1.8	Bratton silt loam, 2 to 6 percent slopes	860	.2
Avonburg-Urban land complex, nearly level	217	.1	Bratton silt loam, 2 to 6 percent slopes, moderately eroded	755	.2
Beasley silt loam, 6 to 12 percent slopes, moderately eroded	153	(1)	Bratton silt loam, 6 to 12 percent slopes, moderately eroded	2,195	.6
Beasley silt loam, 12 to 18 percent slopes, moderately eroded	742	.2	Bratton silt loam, 12 to 18 percent slopes, moderately eroded	376	.1
Berks-Muskingum channery silt loams, 18 to 35 percent slopes	192	.1	Bratton silty clay loam, 12 to 18 percent slopes, severely eroded	73	(1)
Berks-Muskingum channery silt loams, 35 to 50 percent slopes	300	.1	Brookston silt loam	2,892	.8
Berks-Muskingum-Neotoma channery silt loams, 6 to 18 percent slopes	270	.1	Brookston silty clay loam	3,787	1.1
Berks-Muskingum-Neotoma channery silt loams, 18 to 35 percent slopes	278	.1	Cana silt loam, 2 to 6 percent slopes	163	(1)
Berks-Muskingum-Neotoma channery silt loams, 35 to 50 percent slopes	323	.1	Cana silt loam, 6 to 12 percent slopes, moderately eroded	464	.1
Blanchester silt loam	4,402	1.2	Cana silt loam, 12 to 18 percent slopes, moderately eroded	469	.1
Boston-Bratton complex, 6 to 12 percent slopes, moderately eroded	11,970	3.4	Cana silt loam, 18 to 35 percent slopes	261	.1
Boston-Bratton complex, 6 to 12 percent slopes, severely eroded	761	.2	Casco gravelly loam, 12 to 18 percent slopes, severely eroded	155	(1)
Boston-Bratton complex, 12 to 18 percent slopes, moderately eroded	3,795	1.1	Casco gravelly loam, 18 to 35 percent slopes, moderately eroded	340	.1
			Celina silt loam, 2 to 6 percent slopes	1,333	.4

See footnote at end of table.

TABLE 8.—*Approximate acreage and proportionate extent of the soils*—Continued

Soil	Acres	Percent
Celina-Urban land complex, gently sloping	153	(1)
Celina-Xenia silt loams, 0 to 2 percent slopes	240	.1
Celina-Xenia silt loams, 2 to 6 percent slopes	12,469	3.5
Cincinnati silt loam, 2 to 6 percent slopes	1,756	.5
Cincinnati silt loam, 6 to 12 percent slopes, moderately eroded	1,991	.6
Cincinnati silt loam, 12 to 18 percent slopes, moderately eroded	631	.2
Clermont silt loam	28,354	8.1
Colyer-Trappist complex, 12 to 18 percent slopes, moderately eroded	113	(1)
Colyer-Trappist complex, 18 to 35 percent slopes	1,457	.4
Colyer-Trappist complex, 35 to 50 percent slopes	2,404	.7
Crosby silt loam, 0 to 2 percent slopes	733	.2
Crosby-Fincastle silt loams, 0 to 2 percent slopes	3,880	1.1
Crosby-Fincastle silt loams, 2 to 6 percent slopes	862	.2
Crosby-Urban land complex, nearly level	154	(1)
Dana silt loam, 0 to 2 percent slopes	318	.1
Dana silt loam, 2 to 6 percent slopes	547	.1
Dubois silt loam, 0 to 2 percent slopes	1,629	.5
Dubois silt loam, 2 to 6 percent slopes	446	.1
Edenton silt loam, 6 to 12 percent slopes, moderately eroded	158	(1)
Edenton silt loam, 12 to 18 percent slopes, moderately eroded	264	.1
Edenton silt loam, 18 to 35 percent slopes, moderately eroded	290	.1
Eel silt loam	4,068	1.1
Fitchville silt loam, 0 to 2 percent slopes	535	.1
Fitchville silt loam, 2 to 6 percent slopes	446	.1
Fox loam, 6 to 12 percent slopes, moderately eroded	307	.1
Fox loam, 12 to 18 percent slopes, moderately eroded	168	(1)
Fox silt loam, 0 to 2 percent slopes	392	.1
Fox silt loam, 2 to 6 percent slopes	721	.2
Fox clay loam, 6 to 12 percent slopes, severely eroded	93	(1)
Gasconade silty clay loam, 6 to 12 percent slopes	397	.1
Gasconade silty clay loam, 12 to 18 percent slopes, moderately eroded	176	.1
Gasconade flaggy silty clay loam, 18 to 35 percent slopes, moderately eroded	177	.1
Gasconade flaggy silty clay loam, 35 to 50 percent slopes	592	.2
Genesee silt loam	5,829	1.6
Guernsey silt loam, 2 to 6 percent slopes	127	(1)
Guernsey silt loam, 6 to 12 percent slopes	157	(1)
Guernsey silty clay loam, 6 to 12 percent slopes, severely eroded	150	(1)
Guernsey soils, 12 to 18 percent slopes, severely eroded	737	.2
Haubstadt silt loam, 0 to 2 percent slopes	730	.2
Haubstadt silt loam, 2 to 6 percent slopes	12,187	3.5
Haubstadt silt loam, 6 to 12 percent slopes, moderately eroded	4,818	1.4
Haubstadt silt loam, 6 to 12 percent slopes, severely eroded	372	.1
Haubstadt silt loam, 12 to 18 percent slopes, moderately eroded	507	.1
Haubstadt silt loam, 12 to 18 percent slopes, severely eroded	300	.1
Haubstadt-Urban land complex, gently sloping	145	(1)
Haubstadt-Urban land complex, sloping	52	(1)
Hennepin-Miamian silt loams, 18 to 35 percent slopes, moderately eroded	2,176	.6
Hennepin-Miamian silt loams, 35 to 50 percent slopes, moderately eroded	100	(1)
Hennepin-Miamian complex, 12 to 25 percent slopes, severely eroded	3,195	.9
Hickory silt loam, 6 to 12 percent slopes, moderately eroded	1,741	.5
Hickory silt loam, 12 to 18 percent slopes, moderately eroded	4,538	1.3
Hickory silt loam, 18 to 25 percent slopes, moderately eroded	2,235	.6
Hickory silt loam, 25 to 35 percent slopes, moderately eroded	758	.2
Hickory clay loam, 6 to 12 percent slopes, severely eroded	352	.1
Hickory clay loam, 12 to 18 percent slopes, severely eroded	2,016	.6
Hickory clay loam, 18 to 25 percent slopes, severely eroded	201	.1
Jessup silt loam, 12 to 18 percent slopes	228	.1
Johnsburg silt loam, 2 to 8 percent slopes	251	.1
Kendallville silt loam, 2 to 6 percent slopes	781	.2
Kendallville silt loam, 6 to 12 percent slopes, moderately eroded	647	.2
Kendallville silt loam, 12 to 18 percent slopes, moderately eroded	194	.1
Kendallville clay loam, 12 to 18 percent slopes, severely eroded	154	(1)
Lawshe silty clay loam, 2 to 6 percent slopes	105	(1)
Lawshe silty clay loam, 6 to 12 percent slopes, moderately eroded	319	.1
Lawshe silty clay loam, 12 to 18 percent slopes, moderately eroded	781	.2
Lawshe silty clay, 12 to 18 percent slopes, severely eroded	230	.1
Loudon silt loam, 2 to 6 percent slopes	717	.2
Loudon silt loam, 2 to 6 percent slopes, moderately eroded	388	.1
Loudon silt loam, 6 to 12 percent slopes, moderately eroded	3,195	.9
Loudon silt loam, 12 to 18 percent slopes, moderately eroded	1,750	.5
Loudon-Edenton silt loams, 18 to 25 percent slopes, moderately eroded	475	.1
Markland silt loam, 2 to 6 percent slopes	138	(1)
Markland silt loam, 6 to 12 percent slopes, moderately eroded	306	.1
Markland silt loam, 12 to 18 percent slopes, moderately eroded	129	(1)
McGary silt loam, 0 to 4 percent slopes	278	.1
Miamian silt loam, 2 to 6 percent slopes	1,631	.5
Miamian silt loam, 2 to 6 percent slopes, moderately eroded	11,297	3.2
Miamian silt loam, 6 to 12 percent slopes, moderately eroded	11,636	3.3
Miamian silt loam, 12 to 18 percent slopes, moderately eroded	2,312	.6
Miamian silt loam, 18 to 25 percent slopes	210	.1
Miamian clay loam, 6 to 12 percent slopes, severely eroded	2,585	.7
Miamian-Russell silt loams, 2 to 6 percent slopes	9,724	2.7
Miamian-Russell silt loams, 2 to 6 percent slopes, moderately eroded	1,104	.3
Miamian-Russell silt loams, 6 to 12 percent slopes, moderately eroded	664	.2
Miamian-Urban land complex, gently sloping	459	.1
Millsdale silty clay loam	252	.1
Milton silt loam, 2 to 6 percent slopes	742	.2
Milton silt loam, 2 to 6 percent slopes, moderately eroded	562	.2
Milton silt loam, 6 to 12 percent slopes, moderately eroded	879	.2
Milton silt loam, 12 to 18 percent slopes, moderately eroded	355	.1

See footnote at end of table.

TABLE 8.—*Approximate acreage and proportionate extent of the soils*—Continued

Soil	Acres	Percent
Milton clay loam, 6 to 12 percent slopes, severely eroded	160	(1)
Montgomery silty clay loam	699	.2
Negley loam, 6 to 12 percent slopes	1,186	.3
Negley loam, 12 to 18 percent slopes	1,821	.5
Negley loam, 18 to 25 percent slopes	1,612	.4
Negley loam, 25 to 35 percent slopes	655	.2
Negley silt loam, 2 to 6 percent slopes	191	.1
Negley clay loam, 6 to 12 percent slopes, severely eroded	150	(1)
Negley clay loam, 12 to 18 percent slopes, severely eroded	731	.2
Negley-Fox complex, 18 to 35 percent slopes	1,106	.3
Nicholson silt loam, 2 to 6 percent slopes	1,785	.5
Nicholson silt loam, 2 to 6 percent slopes, moderately eroded	114	(1)
Nicholson silt loam, 6 to 12 percent slopes, moderately eroded	180	.1
Ockley silt loam, 0 to 2 percent slopes	141	(1)
Ockley silt loam, 2 to 6 percent slopes	566	.2
Ockley silt loam, 6 to 12 percent slopes, moderately eroded	444	.1
Ockley-Urban land complex, gently sloping	40	(1)
Opequon silt loam, 6 to 18 percent slopes, moderately eroded	1,643	.5
Opequon silt loam, 18 to 25 percent slopes, moderately eroded	1,665	.5
Opequon stony silt loam, 18 to 35 percent slopes, moderately eroded	2,630	.7
Opequon stony silt loam, 35 to 50 percent slopes	992	.3
Opequon clay, 6 to 18 percent slopes, severely eroded	1,881	.5
Otwell silt loam, 2 to 6 percent slopes	2,061	.6
Otwell silt loam, 6 to 12 percent slopes, moderately eroded	2,383	.7
Otwell silt loam, 12 to 18 percent slopes, moderately eroded	1,927	.5
Otwell silt loam, 18 to 25 percent slopes, moderately eroded	1,616	.5
Otwell silt loam, 25 to 35 percent slopes	325	.1
Patton silt loam	312	.1
Patton silt loam, till substratum	1,078	.3
Peoga silt loam	390	.1
Philo silt loam	114	(1)
Ross silt loam	2,944	.8
Rossmoyne silt loam, 0 to 2 percent slopes	595	.2
Rossmoyne silt loam, 2 to 6 percent slopes	27,331	7.8
Rossmoyne silt loam, 2 to 6 percent slopes, moderately eroded	6,085	1.7
Rossmoyne silt loam, 6 to 12 percent slopes, moderately eroded	11,535	3.3
Rossmoyne silt loam, 12 to 18 percent slopes, moderately eroded	269	.1
Rossmoyne silty clay loam, 6 to 12 percent slopes, severely eroded	1,350	.4
Rossmoyne-Urban land complex, gently sloping	128	(1)
Russell silt loam, 2 to 6 percent slopes	210	.1
Sardinia silt loam, 0 to 2 percent slopes	146	(1)
Sardinia silt loam, 2 to 6 percent slopes	690	.2
Sardinia silt loam, 6 to 12 percent slopes, moderately eroded	109	(1)
Shoals silt loam	2,605	.7
Sleeth silt loam, 0 to 2 percent slopes	183	.1
Sloan silt loam	1,632	.5
Stonelick loam	542	.1
Thackery silt loam, 0 to 2 percent slopes	131	(1)
Thackery silt loam, 2 to 6 percent slopes	209	.1
Trappist silt loam, 18 to 25 percent slopes	667	.2
Trappist-Muse silt loams, 2 to 6 percent slopes	180	.1
Trappist-Muse silt loams, 6 to 12 percent slopes, moderately eroded	443	.1
Trappist-Muse silt loams, 12 to 18 percent slopes, moderately eroded	391	.1
Tuscarawas channery silt loam, 6 to 18 percent slopes	220	.1
Tuscarawas channery silt loam, 18 to 35 percent slopes	339	.1
Warsaw silt loam, 0 to 2 percent slopes	236	.1
Wea silt loam, 0 to 2 percent slopes	141	(1)
Wea silt loam, 2 to 6 percent slopes	80	(1)
Wellston silt loam, 6 to 12 percent slopes	45	(1)
Wellston silt loam, 12 to 18 percent slopes	148	(1)
Westland silt loam, overwash	765	.2
Westland silty clay loam	420	.1
Williamsburg silt loam, 0 to 2 percent slopes	91	(1)
Williamsburg silt loam, 2 to 6 percent slopes	350	.1
Williamsburg silt loam, 6 to 12 percent slopes	256	.1
Xenia silt loam, 2 to 6 percent slopes	292	.1
Ponds and streams	2,429	.7
Clay pits	35	(1)
Gravel pits	110	(1)
Quarries	305	.1
Cut and fill land	104	(1)
Areas less than 0.1 acre in size		1.3
Total	351,360	100.0

[1] Less than 0.05 percent.

Algiers Series

The Algiers series consists of somewhat poorly drained, nearly level soils. These soils formed in 12 to 30 inches of recent alluvium that overlies older, dark-colored alluvium. They are on flood plains. The native vegetation was deciduous forest in which elm, sycamore, ash, soft maple, and swamp oak were dominant.

In a representative profile in a cultivated area, the plow layer is dark grayish-brown silt loam 7 inches thick. Between depths of 7 and 22 inches is dark grayish-brown and dark-gray silt loam that is mottled with dark yellowish brown in the lower part. Below a depth of 22 inches is an older buried soil. The upper 9 inches of the buried soil is black silt loam mottled with grayish brown, the next 13 inches is very dark gray loam mottled with dark yellowish brown; and the lower 16 inches is grayish-brown and dark-gray gravelly loam mottled with yellowish brown.

The available water capacity is high in Algiers soils. Permeability is moderate, and surface runoff is slow. These soils are subject to periodic flooding. When the soils are drained, the root zone is deep and is dominantly neutral to mildly alkaline.

Algiers soils are used mainly for corn, soybeans, and some wheat. In frequently flooded areas the soils are used for grass-legume mixtures, for hay, permanent pasture, and woodland. Few areas of Algiers soils are idle.

Representative profile of Algiers silt loam in a cultivated field 3 miles north of Hillsboro on U.S. Highway 62, 1 mile east of Selph Road, ⅝ mile north on Lewis Lane, and ¼ mile north of house, in Liberty Township:

Ap—0 to 7 inches, dark grayish brown (10YR 4/2) silt loam; weak, fine, subangular blocky structure; friable; many roots; 10 percent tubular pores; less than 5 percent pebbles; neutral; abrupt, smooth boundary.

C1—7 to 13 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky; friable; common roots; 10 percent tubular pores; very dark gray (N 3/0) organic stains along old root channels; less than 5 percent pebbles; neutral; clear, smooth boundary.

C2—13 to 18 inches, dark grayish-brown (2.5Y 4/2) silt loam; few, medium, distinct, dark yellowish-brown (10YR 4/4) mottles; weak, medium and coarse, subangular blocky structure; friable; common roots; 10 percent tubular pores; very dark gray (N 3/0) organic stains along old root channels; less than 5 percent pebbles; neutral; clear, wavy boundary.

C3—18 to 22 inches, dark-gray (10YR 4/1) silt loam; common, medium, distinct, dark yellowish-brown (10YR 4/4) mottles; weak, coarse, subangular blocky structure; friable; common roots; 10 percent tubular pores; thin lenses of light brownish-gray (10YR 6/2) sand; few, fine, distinct, black (10YR 2/1) organic stains; less than 5 percent pebbles; neutral; abrupt, wavy boundary.

IIAb—22 to 31 inches, black (10YR 2/1) silt loam, very dark brown (10YR 2/2) when rubbed; few, medium, distinct, grayish-brown (10YR 5/2) mottles; weak thick, platy structure; friable; few roots; 10 percent tubular pores; dark yellowish-brown (10YR 4/4) rinds around old root channels; less than 5 percent pebbles; neutral; clear, wavy boundary.

IIB2bg—31 to 44 inches, very dark gray (10YR 3/1) loam; many dark yellowish-brown (10YR 4/4) mottles; massive; friable; 10 percent tubular pores; 10 percent pebbles; mildly alkaline, calcareous; abrupt, wavy boundary.

IIC—44 to 60 inches, grayish-brown (10YR 5/2) and dark-gray (10YR 4/1) gravelly loam; yellowish-brown (10YR 5/4 and 5/6) mottles; massive; 35 to 50 percent pebbles; mildly alkaline, calcareous.

The solum generally has a subangular blocky structure. Reaction ranges from slightly acid to mildly alkaline throughout the profile but is generally neutral or mildly alkaline.

The Ap horizon is mainly dark grayish brown (10YR 4/2, 2.5Y 4/2) or grayish brown (10YR 5/2, 2.5Y 5/2). The C horizon of the more recently deposited alluvium is dominantly silt loam but includes silty clay loam and loam.

The buried soil is at a depth of 12 to 30 inches. It ranges from loam to silty clay loam.

The IIAb horizon is mainly black (10YR 2/1) or very dark gray (10YR 3/1) but includes very dark brown (10YR 2/2), very dark grayish brown (10YR 3/2), and dark gray (10YR 4/1).

The IIC horizon is generally massive, but in some profiles it is single grained. The matrix of the IIC horizon is yellowish brown (10YR 5/4), dark brown (10YR 4/3), or a color of comparable chroma in a hue of 2.5Y or 7.5YR. The horizon is mottled with chromas of 2 or less. In some profiles, however, the matrix and mottled colors may be reversed. In some areas thin strata of sandy loam, loamy sand, or sand and gravel are in the lower part of the IIC horizon.

The Algiers soils in Highland County are mottled within a depth of 20 inches, which is shallower than defined in the range for the Algiers series. This difference, however, does not alter their usefulness or behavior.

Algiers soils lack the dark-colored surface horizon that is characteristic of Sloan and Ross soils. Algiers soils have a buried, dark-colored horizon that other alluvial soils, such as Genesee, Eel, and Shoals, lack.

Ag—Algiers silt loam. This nearly level soil is on flood plains and along waterways extending into the terraces and uplands. It is in areas where there has been overflow, and silting has taken place. Areas range from 2 to more than 80 acres.

Included with this soil in mapping are better drained Eel and Shoals soils and dark-colored Ross soils. Some included areas have more than 30 inches of recent alluvium over the dark-colored buried horizon. Some included areas have a loam surface layer. Where this soil extends along waterways into the uplands, dark-colored Blanchester soils are commonly included.

This soil is subject to flooding, particularly where it is along small streams. Wetness is a moderate limitation if the soil is farmed. A seasonal high water table and flooding are limitations for most nonfarm uses. Capability unit IIw–1; woodland suitability group 2w1.

Atlas Series

The Atlas series consists of somewhat poorly drained, gently sloping to sloping soils that formed in loess and the underlying moderately fine textured and medium-textured glacial till. The Atlas soils are on uplands, commonly on slopes bordering stream valleys in dissected glacial till plains of Illinoian age. The native vegetation was hardwood forest in which beech, hickory, oak, and maple were dominant.

In a representative profile in a cultivated area, the surface layer is brown and yellowish-brown silt loam 7 inches thick. The subsoil extends to a depth of about 67 inches. The upper 10 inches is dark yellowish-brown clay loam that has gray mottles. Next is 7 inches of gray heavy clay loam that has brown mottles, 6 inches of gray silty clay that has dark yellowish-brown and yellowish-brown mottles, and 21 inches of yellowish-brown silty clay that has gray mottles. The lower 16 inches is strong-brown to brown clay loam that has gray mottles. The substratum, to a depth of 90 inches, is yellowish-brown clay loam in the upper part grading to gravelly loam that has gray mottles in the lower part.

The available water capacity is medium in Atlas soils. Permeability is very slow, and surface runoff is slow to moderate. The root zone is moderately deep and is commonly very strongly acid to medium acid. These soils have a high water table during winter and spring, and they dry out slowly after rain.

Atlas soils are used mainly for farm crops. The main crops are corn, wheat, soybeans, and grass-legume mixtures for hay and silage. Some areas are used for pasture and woods, and a small acreage is idle.

Representative profile of Atlas silt loam, 2 to 6 percent slopes, moderately eroded, in a cultivated field 5 miles west of Hillsboro, ¼ mile south of U.S. Highway 50, ⅛ mile east of Kessler Road, and 125 feet north of stream, in Union Township:

Ap—0 to 7 inches, brown (10YR 5/3) silt loam mixed with patches of yellowish brown (10YR 5/4) which make up 30 percent of the horizon; weak, fine, granular structure; friable; many roots; many vesicular pores; strongly acid; abrupt, smooth boundary.

B1t—7 to 12 inches, dark yellowish-brown (10YR 4/4) clay loam; common, medium, distinct, gray (10YR 5/1) mottles; moderate, fine and medium, subangular blocky structure; friable; common roots; common tubular pores; thin, very patchy, dark-brown (10YR 4/3) clay films on vertical and horizontal ped faces; medium, continuous, light olive-brown (2.5Y 5/4) silt coatings on vertical faces; very strongly acid; abrupt, wavy boundary.

IIB21t—12 to 17 inches, dark yellowish-brown (10YR 4/4) heavy clay loam; many, fine and medium, distinct, gray (10YR 5/1) mottles; strong, fine and medium, angular blocky structure; firm; common roots; few tubular pores; gray (10YR 5/1) ped faces; thin,

patchy, grayish-brown (10YR 5/2) and brown (7.5YR 4/4) clay films on vertical and horizontal ped faces; thin, continuous, grayish-brown (2.5Y 5/2) silt coatings on vertical faces; 5 percent pebbles; very strongly acid; clear, wavy boundary.

IIB22tg—17 to 24 inches, gray (10YR 5/1) heavy clay loam; many, medium, distinct, brown (7.5YR 4/4) and strong-brown (7.5YR 5/6) mottles; strong, medium and fine, angular blocky structure; firm; few roots; few tubular pores; thin, continuous, gray (N 5/0) clay films on vertical and horizontal ped faces and thin, very patchy, dark grayish-brown (10YR 4/2) clay films on horizontal ped faces; 5 percent pebbles; very strongly acid; clear, wavy boundary.

IIB23tg—24 to 30 inches, gray (10YR 5/1) silty clay; common, medium, distinct, dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/6) mottles; weak, coarse, subangular blocky structure parting to moderate, fine, angular blocky; firm; few roots; few tubular pores; thin, patchy, light-gray (10YR 6/1) clay films on vertical and horizontal ped faces; 5 percent pebbles; very strongly acid; clear, wavy boundary.

IIB24t—30 to 44 inches, yellowish-brown (10YR 5/4) silty clay, common; coarse, distinct, gray (10YR 6/1) mottles; weak, coarse, prismatic structure parting to moderate, fine angular blocky; firm; few tubular pores; gray (10YR 5/1) ped faces with thin, patchy, gray (10YR 6/1) and brown (10YR 4/3) clay films on vertical and horizontal ped faces; 5 percent pebbles; very strongly acid; clear, wavy boundary.

IIB31—44 to 51 inches, yellowish-brown (10YR 5/4) silty clay; common, coarse, distinct, gray (10YR 5/1) mottles; weak, coarse, subangular blocky structure; firm; few tubular pores; common, fine, prominent, black (10YR 2/1) stains; 5 percent pebbles; strongly acid; gradual, wavy boundary.

IIB32—51 to 67 inches, strong-brown (7.5YR 5/6) and brown (7.5YR 4/4) clay loam; few, coarse, distinct, gray (10YR 5/1) mottles; weak, medium, subangular blocky structure; firm; few tubular pores; common, fine, prominent, black (10YR 2/1) stains; 5 percent pebbles; neutral; gradual, wavy boundary.

IIC1—67 to 77 inches, yellowish-brown (10YR 5/4) clay loam; few, coarse, distinct, gray (10YR 5/1) mottles; massive; very firm; 15 percent coarse fragments; mildly alkaline, calcareous; gradual, wavy boundary.

IIC2—77 to 90 inches, yellowish-brown (10YR 5/4) gravelly loam; few, coarse, distinct, gray (10YR 5/1) mottles; massive; very firm; 20 percent coarse fragments; calcareous.

Thickness of the solum, and the depth to calcareous till range from 60 to 100 inches. The loess cap is from 0 to 20 inches thick. Reaction in the solum ranges from very strongly acid to medium acid in the B1t and B2t horizons and from strongly acid to neutral in the B3 horizon.

The Ap horizon is yellowish brown (10YR 5/4) to dark grayish brown (10YR 4/2). The B1 horizon is mainly yellowish brown (10YR 5/4 and 5/6) or dark yellowish brown (10YR 4/4). It is clay loam, silty clay loam, or heavy silt loam. The B2t and B3 horizons are clay, silty clay, silty clay loam, or clay loam. The structure of the B1t and B2t horizons is commonly angular and subangular blocky or prismatic parting to angular and subangular blocky.

The B22t and B23t horizons have neutral colors or they have a hue of 7.5YR or 10YR, value of 2 to 6, and chroma of 0 to 6. They have clay films, coatings, and mottles that have neutral colors or a hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6, and chroma of 0 to 6. The B3 horizon is yellowish brown (10YR 5/4) and strong brown (7.5YR 5/6) to light gray (10YR 6/1 or N 6/0) and dark gray (10YR 4/1 or N 4/0) and has common to many bright mottles. The profile is 2 to 20 percent pebbles throughout.

Atlas soils have a thinner loess mantle and a higher clay content below the loess than Avonburg soils, and they do not have a fragipan. Unlike Dubois soils, Atlas soils lack a fragipan, are generally less acid, and are underlaid by glacial till. Unlike Crosby soils, they formed in Illinoian-age till.

AtB—Atlas silt loam, 2 to 6 percent slopes. This gently sloping soil is at the edge of broad, nearly level areas and, in some places, is along small waterways. Areas are 2 to 40 acres in size. This soil has a profile similar to the one described as representative of the series, but more of the original surface layer is in place and, therefore, it is deeper to the fine-textured subsoil.

Included with this soil in mapping are nearly level Avonburg soils that have a fragipan and lack the clayey subsoil. In some places poorly drained Clermont soils are included. Some areas are underlain by limestone bedrock at a depth of 7 to 15 feet.

Wetness is the main limitation for both farm and nonfarm uses of this soil. Tobacco does not grow well because the soil is somewhat poorly drained. Surface drainage is used to remove excess water. The very slow permeability in the subsoil and substratum is a limitation for some nonfarm uses. Capability unit IIIw-2; woodland suitability group 2w2.

AtB2—Atlas silt loam, 2 to 6 percent slopes, moderately eroded. This gently sloping soil is at the edge of broad, nearly level areas and along small waterways. Areas are 2 to 30 acres in size. This soil has the profile described as representative of the series.

Erosion has removed part of the original surface layer, and plowing has mixed part of the moderately fine textured subsoil into the present surface layer. This has caused poorer tilth.

Included with this soil in mapping are nearly level and gently sloping Avonburg soils that have a fragipan and lack the fine-textured subsoil. Commonly included are gently sloping and sloping Rossmoyne soils that have a fragipan, are moderately well drained, and lack the clayey subsoil. Some areas are underlain by limestone bedrock at a depth of 7 to 15 feet.

Wetness is the main limitation in the use of this soil. Erosion is also a limitation for farming. The very slow permeability in the subsoil is a limitation for many nonfarm uses. Capability unit IIIw–2; woodland suitability group 2w2.

AtC2—Atlas silt loam, 6 to 12 percent slopes, moderately eroded. This sloping soil is at the edge of broad, nearly level areas and along small waterways. Areas cover 2 to 30 acres.

Erosion has removed part of the original surface layer of this soil, and plowing has mixed some of the moderately fine textured subsoil into the present surface layer. This has caused poorer tilth.

Included with this soil in mapping are gently sloping Avonburg soils that have a fragipan and lack the fine-textured subsoil material. Commonly included are gently sloping and sloping Rossmoyne soils that have a fragipan, are moderately well drained, and lack the clayey subsoil material. Some areas are underlain by limestone bedrock at a depth of 7 to 15 feet.

Erosion is the main limitation for farming. The very slow permeability in the subsoil is a limitation for some nonfarm uses. Capability unit IVe–3; woodland suitability group 2w2.

AtC3—Atlas silt loam, 6 to 12 percent slopes, severely eroded. This sloping soil is at the edge of broad, nearly level areas and along small waterways. The areas are 2 to 30 acres in size.

This soil has a profile similar to the one described as representative of the series, but it is more eroded. Erosion has removed most of the original surface layer, and

plowing has mixed some of the fine-textured subsoil into the present surface layer. This has caused poorer tilth.

Included with this soil in mapping are gently sloping and sloping Rossmoyne soils that have a fragipan and lack the fine-textured subsoil material. Also included in some places are sloping and moderately steep Hickory soils that lack the clayey horizons in the subsoil and have carbonates at a depth of less than 36 inches. Some areas are underlain by limestone bedrock at a depth of 7 to 15 feet.

Erosion is the main limitation for farming. The very slow permeability in the subsoil is a limitation for some nonfarm uses. Capability unit IVe–3; woodland suitability group 2w2.

Avonburg Series

The Avonburg series consists of somewhat poorly drained, nearly level to gently sloping soils. These soils, formed in loess and the underlying moderately fine textured or medium-textured glacial till. They are on loess mantled, glacial till plains. The native vegetation was deciduous hardwood forest in which sweetgum, ash, oaks, elm, and maple were dominant.

In a representative profile in a cultivated area, the surface layer is dark grayish-brown silt loam 9 inches thick. The subsurface layer is yellowish-brown silt loam that has light brownish-gray mottles and is 6 inches thick. The subsoil extends to a depth of 86 inches. The upper 16 inches is yellowish-brown silt loam that has light brownish-gray mottles in the upper part and gray and strong-brown mottles in the lower part. Next is 8 inches of very firm and brittle, brown silty clay loam that has gray and strong-brown mottles, 8 inches of gray silty clay loam that has strong-brown mottles, and 8 inches of brown clay loam that has gray and strong-brown mottles. The lower 31 inches is yellowish-brown clay loam that has gray and grayish mottles. The substratum is yellowish-brown clay loam that has gray mottles to a depth of 99 inches and is brown gravelly loam between depths of 99 to 124 inches.

The available water capacity is medium in Avonburg soils. Permeability is very slow, and surface runoff ranges from slow to medium. These soils have a high water table during winter and spring, and they dry out slowly after rain. The root zone is moderately deep and is commonly very strongly acid.

Avonburg soils are used mainly for farm crops. The main crops are corn, soybeans, wheat, and grass-legume mixtures for hay and meadow. A large acreage of these soils is used for pasture and woodland, and some is idle.

Representative profile of Avonburg silt loam, 0 to 2 percent slopes, in a cultivated field 1⅛ miles west-northwest of Mowrystown on State Route 321, 1⅛ miles north of the intersection of Stringtown Road and State Route 321, ⅛ mile southeast of the intersection of Stringtown and Marconette Roads, and 50 yards east-northeast of Stringtown Road, in White Oak Township:

Ap—0 to 9 inches, dark grayish-brown (2.5Y 4/2) silt loam; weak, medium, subangular blocky structure; friable; many roots; 15 percent tubular pores; less than 5 percent pebbles; slightly acid; abrupt, irregular boundary.

A2—9 to 15 inches, yellowish-brown (10YR 5/4) silt loam; common, medium, distinct, light brownish-gray (10YR 6/2) mottles; weak, thick, platy structure; friable; common fine roots; 30 percent tubular and vesicular pores; less than 5 percent pebbles; very strongly acid; gradual, wavy boundary.

B1—15 to 22 inches, yellowish-brown (10YR 5/4) silt loam; many, medium, distinct, light brownish-gray (10YR 6/2) mottles and few, medium, faint, yellowish-brown (10YR 5/6) mottles; weak, medium and fine, subangular blocky structure; friable; common fine roots; 15 percent tubular pores; 2 percent gray (10YR 5/1) krotovinas; less than 5 percent pebbles; very strongly acid; clear, wavy boundary.

B21t—22 to 31 inches, yellowish-brown (10YR 5/4) silt loam; many, medium, distinct, gray (10YR 6/1) mottles and common, fine, distinct, strong-brown (7.5YR 5/6) mottles; moderate, medium, subangular blocky structure; friable; common fine roots; 10 percent tubular pores; thin, very patchy, light brownish-gray (10YR 6/2) clay films on vertical and horizontal ped faces that are somewhat irregular and rounded; patchy pale-brown (10YR 6/3) silt coatings on vertical faces; less than 5 percent pebbles; very strongly acid; clear, wavy boundary.

IIBx—31 to 39 inches, brown (10YR 5/3) silty clay loam; many, medium, distinct, gray (10YR 6/1) mottles and common, fine, distinct, strong-brown (7.5YR 5/6) mottles; weak, very coarse, prismatic structure parting to weak, thick, platy; very firm and brittle; common fine roots; 10 percent tubular pores; thin, patchy, gray (10YR 5/1) and brown (10YR 5/3) clay films and pale-brown (10YR 6/3) silt coatings on vertical and horizontal ped faces that are somewhat irregular and rounded; less than 5 percent pebbles; very strongly acid; gradual, wavy boundary.

IIB22t—39 to 47 inches, gray (10YR 6/1) silty clay loam; many, coarse, distinct, strong-brown (7.5YR 5/6) mottles; moderate, medium and fine, subangular blocky structure; firm; thin, patchy, gray (N 5/0) and brown (10YR 5/3) clay films on vertical and horizontal ped faces that are somewhat irregular and rounded; less than 5 percent pebbles; very strongly acid; gradual, wavy boundary.

IIB23t—47 to 55 inches, brown (7.5YR 4/4) clay loam; common, coarse, distinct, gray (10YR 5/1) mottles and common, medium, distinct, strong-brown (7.5YR 5/6) mottles; weak, medium, subangular blocky structure; firm; 5 percent tubular pores; thin, very patchy gray (N 5/0) and dark-brown (7.5YR 4/4) clay films on vertical, somewhat irregular, rounded ped faces; 2 percent light brownish-gray (10YR 6/2) krotovinas; less than 5 percent pebbles; extremely acid; gradual, wavy boundary.

IIB31—55 to 66 inches, yellowish-brown (10YR 5/4) clay loam; common, medium, distinct, gray (10YR 5/1) mottles; weak, coarse and fine, subangular blocky structure; firm; 5 percent tubular pores; less than 5 percent pebbles; very strongly acid; clear, wavy boundary.

IIB32—66 to 86 inches, yellowish-brown (10YR 5/6) clay loam; common, medium, distinct, grayish-brown (2.5Y 5/2) and gray (N 6/0) mottles; moderate, medium and fine, angular blocky structure; firm; 5 percent tubular pores; less than 5 percent pebbles; medium acid; gradual, wavy boundary.

IIC1—86 to 99 inches, yellowish-brown (10YR 5/4) clay loam; common, medium, distinct, gray (N 5/0) mottles; weak, coarse, subangular blocky structure; very firm; 15 percent pebbles; neutral; gradual, wavy boundary.

IIC2—99 to 124 inches, brown (10YR 5/3) gravelly loam; gray (N 6/0) horizontal streaks; massive; very firm; 25 percent pebbles; mildly alkaline, calcareous.

The solum is about 6 to 8 feet thick, the loess mantle is 18 to 40 inches thick. The depth to the fragipan ranges from about 22 to 32 inches. The depth to calcareous glacial till ranges from 80 to 120 inches or more but is typically from 80 to 100 inches. Reaction ranges from extremely acid to strongly acid below the Ap horizon through the middle or lower part of the

fragipan; it is very strongly acid to medium acid in the upper part of the B3 horizon and medium acid to neutral in the lower part of the B3 horizon.

The Ap or A1 horizon is grayish brown (10YR 5/2) to dark grayish brown (2.5Y 4/2). The B2 and Bx horizons are typically silty clay loam, but in some places are silt loam or clay loam.

Avonburg soils are part of the drainage sequence that includes well drained Hickory and Cincinnati soils, the moderately well drained Rossmoyne soils, the poorly drained Clermont soils, the poorly drained, dark-colored Blanchester soils, and the very poorly drained, dark-colored Patton soils. The lower horizons of Avonburg soils developed in glacial till, but the lower horizons of Dubois soils developed in medium-textured to moderately fine textured lacustrine sediment. Avonburg soils have a fragipan, which the similar Fincastle and Sleeth soils lack. Avonburg soils differ from Atlas soils by having a thicker loess mantle, a fragipan, and a higher clay content below the loess.

AvA—Avonburg silt loam, 0 to 2 percent slopes. This nearly level soil is on the Illinoian glacial till plain in broad areas of 3 to more than 200 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are spots of grayish, poorly drained Clermont soils. Also included in some places at the head of drainageways are dark-colored, very poorly drained Blanchester soils. Some areas are underlain by limestone bedrock at a depth of 7 to 12 feet (fig. 3).

Ponding is common on this soil during periods of heavy rainfall. Wetness is a severe limitation in farming, and seasonal wetness and very slow permeability are limitations for most nonfarm uses. Capability unit IIIw–1; woodland suitability group 2w2.

AvB—Avonburg silt loam, 2 to 6 percent slopes. This gently sloping soil is at the edge of broad, nearly level areas on the Illinoian glacial till plain. In some places it is on low rises surrounded by nearly level soils. Areas of this soil cover 2 to 75 acres.

Included with this soil in mapping are spots of nearly level Clermont soils that are grayer and poorly drained. Also included in some places near the head of drainageways are dark-colored, very poorly drained Blanchester soils. Some areas are underlain by limestone bedrock at a depth of 7 to 12 feet.

Wetness is a severe limitation in farming, and seasonal wetness and very slow permeability are limitations for some nonfarm uses. Capability unit IIIw–2; woodland suitability group 2w2.

Figure 3.—**This cut is in an area of Avonburg soils where depth to underlying limestone is 8 to 10 feet.**

AxA—Avonburg-Urban land complex, nearly level. This complex consists of areas where grading and digging have destroyed the original soil. Most areas are used for urban and industrial development, mainly in the villages of Lynchburg and Mowrystown. About 35 to 50 percent of these areas consists of disturbed soil material; the rest is mainly undisturbed Avonburg soils in undeveloped lots, parks, back parts of developed lots, and small patches of woodland.

Because of the level surface, poor internal drainage, and insufficient surface drainage, many residential areas have received 1 to 3 feet of fill material from adjacent Avonburg and Rossmoyne soils. The fill material is silt loam topsoil and clay subsoil material.

Included with this complex in mapping are spots of grayer, poorly drained Clermont soils and nearly level Rossmoyne soils.

The surface layer of the disturbed areas commonly has a low content of organic matter and is in poor physical condition. It can be tilled within only a narrow range of moisture content. Where the clay fill material has been used, seed germination is poor. The hazard of erosion is slight in construction areas that are bare of vegetation. Seasonal wetness and very slow permeability are limitations for most nonfarm uses. Capability unit and woodland suitability group not assigned.

Beasley Series

The Beasley series consists of moderately well drained, sloping to moderately steep soils. These soils formed in thin loess and fine-textured limestone colluvium over shale residuum. They are on unglaciated ridgetops and the upper part of hillsides. The native vegetation was deciduous and coniferous forest in which oak, hickory, and redcedar were some of the dominant trees.

In a representative profile in a cultivated area, the surface layer is dark grayish-brown silt loam 5 inches thick. The subsoil extends to a depth of 31 inches. The upper 8 inches of the subsoil is dark yellowish-brown silty clay loam, and the lower 18 inches is yellowish-brown clay. The substratum is light brownish-gray and light-gray silty clay to a depth of 38 inches. Below that is olive, olive-gray, and reddish-brown soft shale bedrock.

The available water capacity is medium in Beasley soils. Permeability is moderately slow to slow, and surface runoff is medium to rapid. The root zone is moderately deep and is commonly medium acid to very strongly acid. These soils have an occasional high water table because they receive runoff and seepage from adjacent soils.

Beasley soils are used mainly for grass-legume mixtures for hay and permanent pasture. Corn, wheat, soybeans, and some tobacco are grown on the less eroded, sloping soils. Much of the acreage of the steeper soils is in forest or is idle and reverting to forest.

Representative profile of Beasley silt loam, 6 to 12 percent slopes, moderately eroded, 1.3 miles north of Elmville and 225 feet west of Elmville North Road, in Brush Creek Township:

Ap—0 to 5 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine and medium, granular structure; friable; many roots; 10 percent vesicular and tubular pores;

2 percent pebbles; medium acid; abrupt, smooth boundary.

B21t—5 to 13 inches, dark yellowish-brown (10YR 4/4) silty clay loam; weak, medium, subangular blocky structure; firm; common roots; 8 percent tubular pores; thin, patchy, yellowish-brown (10YR 5/4) clay films on vertical and horizontal ped faces; 8 percent pebbles; strongly acid; clear, wavy boundary.

B22t—13 to 31 inches, yellowish-brown (10YR 5/6) clay; few, fine, distinct, strong-brown (7.5YR 5/6) and brown (10YR 5/3) mottles; weak, medium, subangular blocky structure; firm; few roots; 10 percent tubular pores; thin, continuous, dark yellowish-brown (10YR 4/4) clay films on vertical and horizontal ped faces; common, fine, prominent, black (10YR 2/1) stains and concretions; 5 percent pebbles; very strongly acid; abrupt, wavy boundary.

IIC—31 to 38 inches, light brownish-gray (2.5Y 6/2) and light-gray (2.5Y 7/2) silty clay; common, medium, prominent, red (2.5YR 5/6) and reddish-brown (2.5 YR 5/4) mottles; massive parting to weak, coarse, subangular blocky structure; firm; few roots; 5 percent tubular pores; 10 percent pebbles; moderately alkaline, calcareous; clear, wavy boundary.

IIR—38 inches, olive (5Y 5/3), reddish-brown (2.5YR 5/4), and olive-gray (5Y 5/2) shale bedrock; mildly alkaline, calcareous.

The solum is 20 to 40 inches thick, and the loess mantle is 0 to 12 inches thick. The depth to shale bedrock ranges from 30 inches to more than 60 inches. Reaction in the solum ranges from very strongly acid to medium acid.

The Ap horizon is dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), or brown (10YR 4/3 and 5/3).

The B2t horizon has a subangular blocky or angular blocky structure. It is silty clay loam, clay, or silty clay. It ranges from 10 to 38 inches in thickness but is typically 16 to 30 inches thick. It is dark yellowish brown (10YR 4/4), yellowish brown (10YR 5/6), or strong brown (7.5YR 5/6).

The C horizon typically has a hue of 2.5Y but ranges in hue from 5Y to 7.5YR.

Beasley soils lack the till component of Loudon soils. They do not have hard limestone bedrock within a depth of 40 inches as do Bratton soils. They lack the dark-colored A horizon of Lawshe soils. Beasley soils formed in limestone-dominated colluvium, and Guernsey soils formed in shale-dominated colluvium.

BeC2—Beasley silt loam, 6 to 12 percent slopes, moderately eroded. This sloping soil is mainly in unglaciated areas, but in some places it is in Illinoian glaciated areas. It is at the base of adjacent steeper Opequon soils and is generally upslope from Lawshe and Guernsey soils. In some places, however, it occupies the same position on the landscape and is on the same bedrock formation as Lawshe and Guernsey soils.

Areas of this soil are generally narrow, elongated bands and are somewhat irregularly shaped. They are small, ranging from 2 to 10 acres. Slopes are slightly convex, but there are some concave areas. Slopes are only 150 to 300 feet long from top to bottom.

This soil has the profile described as representative of the series. Its surface layer is a mixture of the original surface layer and part of the subsoil.

Included with this soil in mapping are some dark-colored Lawshe soils on the more severely eroded areas along drainageways. Some small areas have many channery and flaggy limestone fragments on the surface. Slightly concave areas and wooded areas that are only slightly eroded are also included.

This soil has a severe hazard of erosion, is stony in some places, and is subject to seepage and overwash from adjacent steeper soils. These are the major limitations for farming. Seepage spots, the moderately slow to slow permeability, shallowness to bedrock, the high shrink-swell potential, and the likelihood of slumping are limitations for most nonfarm uses. Capability unit IVe–3; woodland suitability group 3cl.

BeD2—Beasley silt loam, 12 to 18 percent slopes, moderately eroded. This strongly sloping soil is mainly in unglaciated areas, but in some places it is in Illinoian glaciated areas. Areas of this soil are generally narrow, elongated bands and are somewhat irregularly shaped. They range from 2 to 52 acres in size but are commonly 5 to 20 acres. Slopes are slightly convex, but there are some concave areas. Slopes are only 150 to 300 feet long from top to bottom. Seepage spots and overwash are common in most areas of this soil.

Included in mapping are some dark-colored Lawshe soils on the more eroded areas along the drainageways and on the fringes of this soil. In some included areas, channery and flaggy limestone fragments are on the surface. Some slightly concave areas, wooded areas that are only slightly eroded, and some severely eroded spots are also included.

Slope, seepage and inwash, and erosion make this soil poorly suited to farming. Seepage spots, the moderately slow to slow permeability, shallowness to bedrock, the high shrink-swell potential, and the likelihood of slumping are limitations for most nonfarm uses. Capability unit VIe–2; woodland suitability group 3c2.

Berks Series

The Berks series consists of well-drained, sloping to very steep soils that formed in material weathered from sandstone. They are on rounded and dissected uplands of the unglaciated Allegheny Plateau. The native vegetation was hardwood forest in which oak, maple, yellow-poplar, and dogwood were dominant.

In a representative profile in an uncultivated area undecomposed to partly decomposed leaf litter 3 inches thick covers the surface. Below this is a surface layer of dark grayish-brown channery silt loam 2 inches thick. The subsurface layer and subsoil are yellowish-brown channery silt loam to a depth of 18 inches. The substratum is yellowish-brown and light yellowish-brown very channery silt loam to a depth of 27 inches. Brown and reddish-yellow sandstone is at a depth of 27 inches.

The available water capacity is low in Berks soils. Permeability is moderate, and surface runoff is medium to rapid. The root zone is moderately deep and is commonly medium acid to very strongly acid.

Most areas of this soil are woodland. Some of the sloping and moderately steep areas have been cleared for pasture, but much of this land is now idle and is reverting to woodland.

Representative profile of Berks channery silt loam, from an area of Berks-Muskingum channery silt loams, 35 to 50 percent slopes, in a wooded area 1¼ miles south of Sinking Spring, 135 yards west of State Route 41, and 125 feet north of Straight Creek Road, in Brush Creek Township:

O1—3 inches to 1 inch, deciduous leaf litter.

O2—1 inch to 0, partly decomposed deciduous leaf litter.

A1—0 to 2 inches, dark grayish-brown (10YR 4/2) channery silt loam; moderate, fine and medium, granular structure; very friable; many roots; very dark grayish-

brown (10YR 3/2) organic stains on ped faces; 20 percent sandstone fragments; medium acid; abrupt, wavy boundary.

A2—2 to 6 inches, yellowish-brown (10YR 5/6) channery silt loam; weak, fine and medium, subangular blocky structure; friable to very friable; many roots; very dark grayish-brown (10YR 3/2) organic stains in old root channels; 20 percent sandstone fragments; strongly acid; clear, wavy boundary.

B21—6 to 12 inches, yellowish-brown (10YR 5/4) channery silt loam; weak, fine and medium, subangular blocky structure; friable; common roots; thin, patchy, light yellowish-brown (10YR 6/4) silt coatings on vertical and horizontal ped faces; 45 percent sandstone fragments and flagstones; strongly acid; gradual, wavy boundary.

B22—12 to 18 inches, yellowish-brown (10YR 5/4) channery silt loam; weak, medium and coarse, subangular blocky structure; friable; common roots; thin, patchy, light yellowish-brown (10YR 6/4) silt coatings on vertical and horizontal ped faces; 55 percent sandstone fragments and flagstones; very strongly acid; gradual, wavy boundary.

C—18 to 27 inches, yellowish-brown (10YR 5/4) to light yellowish-brown (10YR 6/4) very channery silt loam; weak, medium and coarse, subangular blocky structure; friable; common roots; 80 percent sandstone fragments and flagstones; very strongly acid; abrupt, irregular boundary.

R—27 inches, acid Berea sandstone with brown (10YR 4/3) exteriors and reddish-yellow (7.5YR 6/8) interiors.

The solum is 18 to 36 inches thick, and depth to sandstone bedrock is 20 to 40 inches. Sandstone fragments make up 20 to 40 percent of the A horizon and 40 to 90 percent of the B and C horizons. Reaction is medium acid or strongly acid in the upper part of the solum and very strongly acid or extremely acid in the lower part and in the C horizon.

The A1 horizon is very dark grayish brown (10YR 3/2) to brown (10YR 5/3). It is 1 to 3 inches thick. The B horizon is channery silt loam or loam. The B2 horizon is 6 to 20 inches thick. The B and C horizons have hues of 7.5YR and 10YR.

Berks soils have a lighter colored A horizon and are shallower to sandstone bedrock than Neotoma soils. They have less clay, more sand, and are more channery in the B2 horizon than Muskingum soils. Berks soils are more channery and are shallower to bedrock than Wellston soils.

BgF—Berks-Muskingum channery silt loams, 18 to 35 percent slopes. This steep complex is on dissected hillsides on the unglaciated Allegheny Plateau. It is mainly on west- and south-facing slopes. Areas of this complex are irregularly shaped and cover 5 to 30 acres. Slopes are medium to long and are convex.

About 55 percent of the acreage of this complex is Berks soils, and 30 percent is Muskingum soils. These soils are below Wellston soils that are on ridgetops, are near steeper Berks-Muskingum or Berks-Muskingum-Neotoma complexes, and are upslope from Tuscarawas soils or Colyer-Trappist complexes. One of the Muskingum soils in this complex has the profile described as representative of the Muskingum series.

Included with these soils in mapping are a few spots that are moderately eroded. These eroded spots have a surface layer that is a mixture of the original surface layer and part of the subsoil. It is browner and contains more sandstone fragments than the surface layer of the soil described as representative of the Berks series. Also included are dark-colored Neotoma soils in coves and on northeast-facing slopes and a few areas of Tuscarawas soils at the base of the slopes.

Stoniness, steep slopes, shallowness to bedrock, and a severe hazard of erosion make this complex poorly suited to farming and to many nonfarm uses. It is suited to pasture, woodland, wildlife habitat, and many recreation uses, such as hiking, horseback riding, and hunting. Capability unit VIe–3; woodland suitability group 4f1.

BgG—Berks-Muskingum channery silt loams, 35 to 50 percent slopes. This very steep complex is on dissected hillsides on the unglaciated Allegheny Plateau. It is mainly on west- and south-facing slopes, but it does occupy some north- and east-facing slopes. Areas of this complex are irregularly shaped and cover 5 to 40 acres. One area of this complex near High Knob just north of the Adams County line is larger than 200 acres, but most areas are 15 to 40 acres. Slopes are medium to long and are convex.

About 70 percent of the acreage of this complex is Berks soils, and 30 percent is Muskingum soils. These soils are below Wellston soils that are on ridgetops, are near steeper Berks-Muskingum or Berks-Muskingum-Neotoma complexes, and are upslope from Tuscarawas soils or Colyer-Trappist complexes. One of the Berks soils in this complex has the profile described as representative of the Berks series.

Included with these soils in mapping are dark-colored Neotoma soils in coves and on northeast-facing slopes and Tuscarawas soils at the base of the slopes.

This complex is more droughty than less steep Berks-Muskingum mapping units, but it is well suited to trees. It is commonly used for woodland or for wildlife habitat and recreation. Very few areas have been completely cleared of trees. Because moisture conditions are not favorable, less desirable trees grow naturally on this complex. Logging trails are moderately to severely eroded, and some gullies have exposed rock material. Capability unit VIIe-2; woodland suitability group 4f2.

BhD—Berks-Muskingum-Neotoma channery silt loams, 6 to 18 percent slopes. This sloping to moderately steep complex is on the long, narrow, uniformly shaped benches on hillsides on the unglaciated Allegheny Plateau. These benches are downslope from steeper Berks-Muskingum-Neotoma complexes and upslope from Colyer-Trappist or Trappist-Muse complexes or Tuscarawas soils. The benches are at the contact between two bedrock formations that consist of sandstone overlying shale bedrock.

Areas of this complex cover 2 to 25 acres. Slopes are short and generally convex, but some small areas are concave. The amount of channery and flaggy fragments on the soil surface varies widely within short distances.

About 45 percent of the acreage is Berks soils, 25 percent is Muskingum soils, and 10 percent is Neotoma soils. The Neotoma soils are in coves or on the north- to east-facing slopes.

Included with these soils in mapping are colluvial Tuscarawas soils, fine-textured Trappist and Muse soils. and Wellston soils. The Trappist and Muse soils have no fragments on the surface.

This complex is suited to limited farming and to pasture. Because it is stony and shallow to bedrock, it is better suited to woodland. Trees grow best on the Neotoma soils. The complex is also suitable for recreation uses and wildlife habitat. Capability unit IVe–5; woodland suitability group 4f1.

BhF—Berks-Muskingum-Neotoma channery silt loams, 18 to 35 percent slopes. This steep complex is on hillsides on the unglaciated Allegheny Plateau. The soils are mainly in a circular pattern around high hills that have a cap of sandstone bedrock; for example, Irons Moun-

tain. Areas of this complex are relatively uniform in shape; they are long and are 150 to 1300 feet wide. The areas are generally large, covering as much as 200 acres, but a few areas are only 10 to 30 acres.

About 55 percent of the acreage is Berks soils, 20 percent is Muskingum soils, and 15 percent is Neotoma soils. The dark-colored Neotoma soils are always in or on the north- to east-facing slopes. One of the Neotoma soils in this complex has the profile described as representative of the Neotoma series. As slope increases, there is an increase in the proportion of Berks soils and in the number and size of sandstone fragments on the surface. Also, the underlying bedrock is nearer the surface.

This complex is below upslope or ridgetop Johnsburg and Wellston soils and above downslope Colyer-Trappist complexes and Tuscarawas soils.

Included with these soils in mapping are very small areas of Tuscarawas or Colyer and Trappist soils at the base of the slopes and of Wellston soils at the top.

This soil complex is best suited to woodland, recreation uses, and wildlife habitat. Trees grow best on the Neotoma soils. Steep slopes, stoniness, shallowness to bedrock, and a severe hazard of erosion when vegetative cover is removed are the main limitations to use of this complex. Capability unit VIe-3; woodland suitability group 4f1.

BhG—Berks-Muskingum-Neotoma channery silt loams, 35 to 50 percent slopes. This very steep soil complex is on the hillsides on the unglaciated Allegheny Plateau. It is in long, uniformly shaped areas that are generally 150 to 350 feet wide and cover 10 to 65 acres. The soils are mainly in a circular pattern around high hills that have a cap of sandstone bedrock; for example, Washburn Hill. Slopes are short, convex, and, in some areas, are steeper than 50 percent.

About 65 percent of the acreage is Berks soils, 15 percent is Muskingum soils, and 15 percent is Neotoma soils. The dark-colored Neotoma soils are in coves or on the north- to east-facing slopes. As slope increases, there is an increase in the proportion of Berks soils and in the number and size of sandstone fragments on the surface. Also, the underlying bedrock is nearer the surface. The underlying bedrock in this complex is generally nearer the surface than in the less steep Berks-Muskingum-Neotoma complexes.

This complex is below upslope or ridgetop Johnsburg and Wellston soils and above downslope Colyer-Trappist complexes and Tuscarawas soils.

Included with these soils in mapping are very small areas of Tuscarawas or Colyer and Trappist soils at the base of the slopes and Wellston soils at the top. Also included are many abandoned quarries.

Slope is the main limitation for most uses. The soils are best suited to woodland, wildlife habitat, or recreation uses. Trees grow best on the Neotoma soils. Capability unit VIIe–2; woodland suitability group 4f2.

Blanchester Series

The Blanchester series consists of poorly-drained, nearly level soils. These soils formed in loess mantled, moderately fine textured glacial till of Illinoian Age. They are on loess-mantled glacial till plains. The native vegetation was hardwood forest in which pin oak, swamp white oak, elm, red maple, and silver maple were dominant.

A representative profile in a cultivated area, the surface layer is dark-gray silt loam 9 inches thick. The subsoil extends to a depth of 51 inches. The upper 12 inches is dark-gray silty clay loam that has dark yellowish-brown, light brownish-gray, and yellowish-brown mottles. The next 14 inches is gray silty clay loam that has yellowish-brown and light brownish-gray mottles. The next 9 inches is pale-brown silty clay loam that has strong-brown mottles. The lower 7 inches is gray silty clay loam that has strong-brown mottles. The substratum is strong-brown clay loam that has gray mottles to a depth of 70 inches and is yellowish-brown silty clay loam that has gray mottles to a depth of 84 inches.

The available water capacity is medium in Blanchester soils. The content of organic matter is medium in the plow layer. Permeability is slow. Surface runoff is slow, and the soils are ponded periodically. The root zone is deep and is commonly medium acid to strongly acid.

Blanchester soils are used mainly for corn, soybeans, wheat, and grass-legume mixtures for hay and meadow. A large acreage of these soils is in pasture and woodland, and some is idle.

Representative profile of Blanchester silt loam, in a cultivated field 0.25 mile south of the intersection of Johnson and Sharpsville Roads, 0.1 mile east of Johnson Road, approximately 6.7 miles west and 3.5 miles north of Hillsboro, in Union Township:

Ap—0 to 9 inches, dark-gray (10YR 4/1) silt loam; common, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; weak, medium, granular structure; friable; common roots; slightly acid; abrupt, smooth boundary.

B1tg—9 to 15 inches, dark-gray (N 4/0) silty clay loam; many, fine, distinct, dark yellowish-brown (10YR 4/4) mottles and common, medium, prominent, yellowish-brown (10YR 5/6) mottles; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky; firm; few fine roots; thin, very patchy, dark-gray (N 4/0) clay films on vertical and horizontal ped faces; strongly acid; clear, smooth boundary.

B21tg—15 to 21 inches, dark-gray (N 4/0) silty clay loam; many, fine, distinct, light brownish-gray (10YR 6/2) mottles and common, coarse, prominent, yellowish-brown (10YR 5/6) mottles; strong, coarse, prismatic structure parting to moderate, medium and coarse, angular blocky; very firm; few roots; thin, patchy, dark-gray (N 4/0) clay films on vertical and horizontal ped faces; medium acid; diffuse, smooth boundary.

B22tg—21 to 35 inches, gray (10YR 5/1) silty clay loam; many, medium and coarse, prominent, yellowish-brown (10YR 5/6) mottles and common, fine, distinct, light brownish-gray (10YR 6/2) mottles; strong, coarse, prismatic structure parting to moderate, coarse, angular blocky; very firm; few fine roots; medium, patchy, dark-gray (N 4/0) clay films on vertical and horizontal ped faces and in old root channels; medium acid; clear, wavy boundary.

IIB23tg—35 to 44 inches, pale-brown (10YR 6/3) heavy silty clay loam; many, medium and coarse, prominent, strong-brown (7.5YR 5/8) mottles; weak, coarse, prismatic structure parting to moderate, coarse, subangular blocky; firm; few fine roots; 3 percent pebbles; medium, patchy, dark-gray (N 4/0) clay films on vertical and horizontal ped faces and in old root channels; slightly acid; gradual, wavy boundary.

IIB3tg—44 to 51 inches, gray (10YR 6/1) silty clay loam; many, coarse, prominent, strong-brown (7.5YR 5/8) mottles; moderate, coarse, subangular blocky structure; firm; few fine roots; 5 percent pebbles; medium, patchy, gray (N 5/0) and dark-gray (N 4/0) clay films on vertical and horizontal ped faces; neutral; gradual, wavy boundary.

IIC1—51 to 70 inches, strong-brown (7.5YR 5/6) clay loam; few, fine, distinct, gray (10YR 5/1) mottles; massive; friable; 5 percent pebbles; neutral; gradual, wavy boundary.

IIC2—70 to 84 inches, yellowish-brown (10YR 5/6) heavy silty clay loam; many, medium and coarse, distinct, gray (10YR 5/1) mottles; massive; friable; 5 percent pebbles; mildly alkaline; calcareous below a depth of 80 inches.

The loess cap is 18 to 40 inches thick. Reaction is strongly acid to medium acid in the B1 horizon and in the upper part of the B2 horizon and is slightly acid to neutral in the lower part. Reaction in the IIB3 horizon ranges from neutral to moderately alkaline. The depth to calcareous glacial till ranges from 70 inches to more than 130 inches but is commonly 70 to 100 inches.

The Ap horizon is dark gray (10YR 4/1), very dark gray (10YR 3/1), and very dark grayish brown (10YR 3/2).

The B horizon is neutral or has a hue of 10YR and 2.5Y, value of 4 through 6, and chroma of 0 through 2. Mottles in the B horizon have a hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 2 through 8. The upper part of the B horizon developed in loess and ranges from medium silty clay loam to heavy silt loam. The lower part of the B horizon developed in glacial till and is silty clay loam, clay loam, or clay.

Blanchester soils are part of the drainage sequence that includes well drained Cincinnati soils, moderately well drained Rossmoyne soils, somewhat poorly drained Avonburg soils, poorly drained Clermont soils, and very poorly drained, dark-colored Patton soils. Moderately well drained to well drained Hickory soils are nearby. Blanchester soils formed in glacial till, and Patton soils formed in silty lacustrine sediment. Blanchester soils have a dark-colored A horizon which Clermont soils lack.

Bk—Blanchester silt loam. This nearly level soil is in broad areas and at the head of drainageways on the Illinoian till plain. In some places it extends down along the drainageways. It is often referred to as "crawfish land." Areas cover 3 to more than 100 acres. Some areas of this soil are underlain by limestone bedrock at a depth of 7 to 15 feet.

Included with this soil in mapping are nearly level and depressional soils that have a thicker surface layer. On slightly higher positions on the landscapes light-colored Clermont or better drained Avonburg soils are included. Where this soil extends down along drainageways, areas of Algiers soils are included.

Wetness is the main limitation in using this soil. Surface drainage is commonly used. A seasonal high water table and slow permeability in the subsoil are limitations for most nonfarm uses. Capability unit IIw-4; woodland suitability group 2w1.

Boston Series

The Boston series consists of well-drained, gently sloping to steep soils. These soils formed in loess, Illinoian till, and clayey residuum weathered from limestone. They are on dissected, glacial till uplands. The native vegetation was hardwood forest in which maple, oak, hickory, beech, and yellow-poplar were dominant.

In a representative profile, in a cultivated area, the surface layer is dark grayish-brown silt loam 8 inches thick. The subsurface layer is brown and yellowish-brown silt loam 4 inches thick. The subsoil extends to a depth of 53 inches. The upper 6 inches of the subsoil is yellowish-brown silty clay loam; the next 14 inches is mottled, yellowish-brown, very firm and brittle silty clay loam; and the lower 21 inches is reddish-brown clay that has brown mottles. The substratum extends to a depth of 58 inches. It is yellowish-brown sandy clay loam. Below that is limestone bedrock.

The available water capacity is medium in Boston soils. Permeability is moderately slow, and surface runoff is medium to high. The root zone is moderately deep and is commonly neutral to strongly acid.

Boston soils are used mainly for farm crops. The main crops are corn, wheat, and grass-legume mixtures for hay and pasture. Soybeans and tobacco are also grown. Much of the acreage is in permanent pasture, and many of the more sloping areas are wooded. Many of the eroded and depleted areas are idle and are reverting to woodland.

Representative profile of Boston silt loam, in an area of Boston-Grayford silt loams, 2 to 6 percent slopes, in a cultivated field 2¼ miles east of Hillsboro on U.S. Highway 50, 0.8 miles south-southeast on Haggerty Road, 300 yards west of Haggerty Road, and 45 yards south of woods, in Liberty Township:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine and medium, granular structure; very friable; many roots; neutral; abrupt, smooth boundary.

A&B—8 to 12 inches, 70 percent brown (10YR 4/3) and 30 percent yellowish-brown (10YR 5/4) silt loam; weak; thick, platy structure parting to weak, fine, subangular blocky; friable; many roots; medium acid; clear, wavy boundary.

B2t—12 to 18 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; firm; common roots; thin, patchy, yellowish-brown (10YR 5/4) and dark yellowish-brown (10YR 4/4) clay films on vertical and horizontal ped faces; strongly acid; clear, wavy boundary.

IIBx1—18 to 23 inches, yellowish-brown (10YR 5/6) silty clay loam; common, medium, faint, yellowish-brown (10YR 5/4) mottles; weak, very coarse, prismatic structure parting to weak, thick, platy; very firm and brittle; few roots; thin, patchy, dark yellowish-brown (10YR 4/4) clay films and thin, patchy, pale-brown (10YR 6/3) silt coatings on vertical ped faces; common, medium, prominent, very dark brown (10YR 2/2) stains and concretions; 5 percent glacial pebbles; strongly acid; gradual, wavy boundary.

IIBx2—23 to 32 inches, yellowish-brown (10YR 5/6) silty clay loam; common, medium, faint, yellowish-brown (10YR 5/4) mottles; moderate, very coarse, prismatic structure parting to weak, thick and very thick, platy; very firm and brittle; few roots; thin, very patchy, dark yellowish-brown (10YR 4/4) clay films and thin, very patchy, pale-brown (10YR 6/3) silt coatings on vertical ped faces; common, medium, prominent, black (10YR 2/1) stains and concretions; 10 percent glacial pebbles; slightly acid; clear, wavy boundary.

IIIB3—32 to 53 inches, reddish-brown (5YR 4/4) clay; common, medium, distinct, brown (7.5YR 4/4) mottles; weak, coarse, subangular blocky structure parting to moderate, very fine and fine, angular blocky; very firm; dark yellowish-brown (10YR 4/4) pressure faces; common, medium, prominent, black (10YR 2/1) stains and concretions; neutral to a depth of 42 inches, mildly alkaline below that; abrupt, irregular boundary.

IIIC—53 to 58 inches, yellowish-brown (10YR 5/6) sandy clay loam; dark-brown (10YR 4/3) tongues and pockets of material from the B3 horizon; massive; very friable; mildly alkaline, calcareous.

IIIR—58 inches, limestone bedrock.

The loess is 6 to 24 inches thick. Depth to the fragipan ranges from 18 to 30 inches, and the fragipan is 6 to 24 inches thick. The fragipan developed in glacial till or in loess and glacial till. It consists of 5 to 15 percent coarse fragments of igneous pebbles and chert, limestone, and shale fragments. The glacial till is 6 to 24 inches thick. Reaction in the solum ranges from neutral to very strongly acid through the Bx

horizon and from medium acid to mildly alkaline in the B3 horizon. Depth to limestone residuum ranges from 26 to 42 inches but typically is 32 to 40 inches. The limestone residuum ranges from 12 to 65 inches or more in thickness, but it is typically 20 to 34 inches thick. Depth to limestone bedrock ranges from 42 to 96 inches but typically is 50 to 70 inches.

The Ap horizon is dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), and brown (10YR 4/3 and 5/3). Profiles in wooded or other undisturbed areas have a very dark grayish-brown (10YR 3/2), very dark gray (10YR 3/1), or dark-gray (10YR 4/1) A1 horizon 1 to 4 inches thick. The A&B horizon is yellowish brown (10YR 5/4 and 5/6) or brown (10YR 4/3 and 5/3).

The B2t horizon above the fragipan is 6 to 20 inches thick. It is silty clay loam or clay loam. The B2t and Bx horizons are typically yellowish-brown (10YR 5/4 and 5/6) or dark yellowish-brown (10YR 4/4 and 3/4) or of similar values and chromas in a hue of 7.5YR. The B2t horizon has thin to medium, very patchy to patchy clay films that have a hue of 10YR to 7.5YR, value of 3 to 5, and chroma of 3 to 6. Silt coatings that are pale brown (10YR 6/3) or light yellowish-brown (10YR 6/4) when moist and light gray (10YR 7/1 and 7/2) or white (10YR 8/1 and 8/2) when dry are on ped faces in the lower part of the B2t horizon and in the Bx horizon.

The IIIB3 horizon is clay or silty clay. It has a hue of 2.5YR to 10YR and chroma of 4 or 5.

The C horizon is 1 to 10 inches thick. It has a hue of 10YR, value of 5 or 6, and chroma of 1 to 6.

Boston soils differ from Cincinnati and Rossmoyne soils in having a fine-textured B3 horizon that formed in limestone residuum rather than in glacial till. Unlike Nicholson soils, Boston soils formed partly in glacial till. They are underlain by fine-textured limestone residuum and limestone bedrock, and Otwell soils are underlain by outwash materials. They have a fragipan, which Grayford and Bratton soils lack.

BmC2—Boston-Bratton complex, 6 to 12 percent slopes, moderately eroded. This sloping complex is on ridgetops and hillsides and, in some places, at the head of drainageways. Areas range from 4 acres to more than 100 acres. Boston soils make up about 60 percent of this complex, and Bratton soils make up 25 percent.

Erosion has removed part of the original surface layer, and plowing has mixed the yellowish-brown subsoil into the present surface layer. Sink holes are common in areas of this complex.

Included with these soils in mapping are gently sloping and sloping Rossmoyne and Cincinnati soils that have a fragipan but do not have the limestone residuum in the lower part of the subsoil. In some places where this complex lies below steeper slopes, Hickory soils are included. Opequon soils are commonly included where the complex lies above steeper slopes. Opequon soils do not have evidence of till and are underlain by limestone at a depth of less than 20 inches. Also included are small areas where the soils are slightly eroded. In these areas Grayford soils are included.

The hazard of erosion is severe if the soils of this complex are used for cultivated crops. The moderately slow permeability in the lower part of the subsoil and underlying limestone are major limitations for many nonfarm uses. Capability unit IIIe–1; woodland suitability group 2o1.

BmC3—Boston-Bratton complex, 6 to 12 percent slopes, severely eroded. This sloping complex is on ridges, along streams, and in coves that are traversed by several waterways. It is commonly along the lower edge of gently sloping areas. Areas range from 2 to 25 acres. About 50 percent of this complex is Boston soils, and 35 percent is Bratton soils.

The profiles of the soils in this complex differ from the profiles described as representative of the Boston and Bratton series. These soils have a surface layer of silty clay loam and clay loam, are not so deep to bedrock, and have more stone fragments on the surface. Erosion has removed most of the original surface layer, and bedrock is at or near the surface in some places. Because of this, the soils are shallow and droughty.

Included with these soils in mapping are Opequon soils that have limestone at a depth of less than 20 inches and less sloping Loudon soils that are underlain by calcareous shale. Rossmoyne soils that have a fragipan and are underlain by till are included in some less eroded areas.

Erosion is the main hazard in farming these soils. Shallowness to the underlying bedrock is a severe limitation for most nonfarm uses. Capability unit IVe–1; woodland suitability group 2o1.

BmD2—Boston-Bratton complex, 12 to 18 percent slopes, moderately eroded. This moderately steep complex is on benches and hillsides and, in some places, at the head of and along drainageways. Areas range from 4 acres to more than 70 acres. About 45 percent of the complex is Boston soils, and 35 percent is Bratton soils.

Erosion has removed part of the original surface layer. In some places plowing has mixed the upper part of the yellowish-brown subsoil into the surface layer. Sink holes are common.

Included with these soils in mapping are Rossmoyne and Cincinnati soils that have a fragipan but do not have limestone residuum in the lower part of the subsoil. In some places where this complex lies below steeper slopes, Hickory soils are included. Opequon soils are commonly included where the complex lies above steeper slopes. Opequon soils lack evidence of till and are underlain by limestone at a depth of less than 20 inches. Also included are small areas of slightly eroded soils.

The hazard of erosion is very severe if the soils of this complex are used for cultivated crops. Moderately slow permeability in the subsoil, slope, and underlying limestone are major limitations for many nonfarm uses. Capability unit IVe-1; woodland suitability group 2r1.

BmD3—Boston-Bratton complex, 12 to 18 percent slopes, severely eroded. This moderately steep complex is on side slopes and at the head of drainageways. It is commonly in coves where several waterways start. In most places there are less sloping areas above and below the moderately steep areas. Areas of this complex range from 2 to 25 acres. About 40 percent of the complex is Boston soils, and 40 percent is Bratton soils.

The profiles of the soils in this complex differ from the profiles described as representative of the Boston and Bratton series. These soils have a surface layer of silty clay loam or clay loam, are not so deep to bedrock, and have more stone fragments on the surface. Erosion has removed most of the original surface layer, and bedrock is at or near the surface in some places. Because of this, the soils are shallow and droughty. Small gullies are common in areas of this complex.

Included with these soils in mapping are Opequon soils that have limestone at a depth of less than 20 inches and less sloping Loudon soils that are underlain by calcareous shale. Also included in some places are less eroded areas of sloping Rossmoyne soils that have a fragipan and are underlain by till.

Erosion is the main hazard to farming these soils. Slope and underlying bedrock are limitations for most nonfarm uses. Capability unit VIe–2; woodland suitability group 2r1.

BmE2—Boston-Bratton complex, 18 to 25 percent slopes, moderately eroded. This steep complex is on side slopes along small drainageways. Most areas are wooded and range from 2 to 20 acres. About 50 percent of the complex is Boston soils, and 35 percent is Bratton soils. The steeper soils commonly have a thin, dark-colored surface layer. Bedrock outcrops are common.

Included with these soils in mapping are Cincinnati, Opequon, and Loudon soils. Cincinnati soils have a fragipan but lack limestone residuum in the lower part of the subsoil. The steeper Opequon soils are shallow to limestone, and the less sloping Loudon soils are underlain by calcareous shale.

Slope, the hazard of erosion, and shallowness to limestone are limitations for most nonfarm uses. Capability unit VIe–2; woodland suitability group 2r1.

BnB—Boston-Grayford silt loams, 2 to 6 percent slopes. This gently sloping complex is on ridgetops and broad side slopes and, in some places, at the head of drainageways. Areas range from 4 to more than 100 acres in size. About 60 percent of the complex is Boston soil, and 35 percent is Grayford soil. The Boston soil in this complex has the profile described as representative of the Boston series. Sink holes are common in areas of this complex.

Included with these soils in mapping are Rossmoyne and Cincinnati soils, which have a fragipan but do not have limestone residuum in the lower part of the subsoil. Steeper Bratton soils that are somewhat shallow to limestone are also included.

Erosion is the main hazard for farming the soils of this complex. The moderately slow permeability in the lower part of the subsoil and shallowness to limestone are limitations for some nonfarm uses. Capability unit IIe–1; woodland suitability group 2o1.

BnB2—Boston-Grayford silt loams, 2 to 6 percent slopes, moderately eroded. This gently sloping complex is on ridgetops and side slopes and, in some places, at the head of drainageways. Areas range from 4 to more than 100 acres in size. About 60 percent of the complex is Boston soil, and 30 percent is Grayford soil. The Grayford soil in this complex has the profile described as representative of the Grayford series.

Erosion has removed part of the original surface layer of these soils, and plowing has mixed some of the upper part of the yellowish-brown subsoil into the surface layer. The loss of soil material has resulted in a thinner root zone and a lower available water capacity. Sink holes are common.

Included with these soils in mapping are Rossmoyne and Cincinnati soils, which have a fragipan but do not have limestone residuum in the lower part of the subsoil. Steeper Opequon and Bratton soils are also included. Opequon and Bratton soils lack till material, and Opequon soils are underlain by limestone at a depth of less than 20 inches.

Erosion is the main hazard for farming. The moderately slow permeability in the subsoil and shallowness to limestone are limitations for some nonfarm uses. Capability unit IIe–1; woodland suitability group 2o1.

BoB—Boston-Urban land complex, gently sloping. This complex consists of areas where grading and digging have destroyed or covered the original soil. Most areas have fill or borrow material and are used mainly for urban and industrial development. There are areas of undisturbed Boston soils in undeveloped lots, undisturbed parts of industrial areas, cemeteries, playgrounds, back parts of developed lots, and small wooded areas.

The fill areas are adjacent to areas of undisturbed Boston soils. The fill material is about 1 to 3 feet of clay loam till and clay residual material.

Included in mapping are areas of Rossmoyne and Cincinnati soils.

The surface layer of the disturbed areas commonly has a low content of organic matter and is in poor physical condition. Seed germination is usually poor because of the high clay content of the limestone residual material. The hazard of erosion is moderate, particularly in construction areas that are without plant cover. Digging operations are frequently hampered by shallowness to limestone bedrock. In addition, if the soil is dry, it is somewhat difficult to excavate. Grading also is somewhat hampered by the stickiness and plasticity of the clay residual material. Capability unit and woodland suitability group not assigned.

BoC—Boston-Urban land complex, sloping. This complex consists of areas where grading and digging have destroyed or covered much of the original soil. Most of these areas are used for urban and industrial development in and near Hillsboro.

Most areas of this mapping unit consist of fill or borrow material, but there are areas of undisturbed Boston soils in undeveloped lots, in the back parts of developed lots, and in small wooded areas.

The fill areas are adjacent to areas of undisturbed Boston soils. The fill material is about 1 to 3 feet of clay loam till and clay residual material. Borrow areas are characterized by exposed bedrock and residual material typical of the Boston soils.

This complex contains slightly more clay than Boston-Urban land complex, gently sloping. Also, it is generally shallower to limestone residual material and to bedrock.

Included with this complex in mapping are Bratton soils and some areas of Rossmoyne, Hickory, and Cincinnati soils.

The surface layer of the disturbed areas commonly has a low content of organic matter and is in poor physical condition. It is hard when dry. The hazard of erosion is moderate to severe, particularly in construction areas that are without plant cover. Shallowness to bedrock, difficulty of excavation when dry, and stickiness and plasticity of the clay residual material are limitations for excavation and grading. Retaining walls are commonly used on upslope lot lines. Capability unit and woodland suitability group not assigned.

Bratton Series

The Bratton series consists of well-drained, gently sloping to steep soils. These soils formed in thin deposits of loess and the underlying, fine-textured residuum weathered from limestone bedrock. They are on dissected, loess-capped limestone areas of both the unglaciated and the Illinoian glaciated uplands. The native vegetation was hardwood forest of beech, oak, hickory, and maple.

In a representative profile in a cultivated area, the plow layer is dark grayish-brown silt loam 10 inches thick. The subsoil extends to a depth of 38 inches. The upper 6 inches is brown and dark grayish-brown silt loam. The next 9 inches is reddish-brown clay. The next 8 inches is dark reddish-brown clay. The lower 5 inches is dark-brown clay. The substratum is light yellowish-brown sandy loam 2 inches thick. Limestone bedrock is at a depth of 40 inches.

The available water capacity is medium in Bratton soils. Permeability is moderately slow, and surface runoff is medium to high. The root zone is moderately deep and is neutral to strongly acid.

Bratton soils are used for farming. Corn, wheat, oats, soybeans, and tobacco and grass-legume mixtures for hay and pasture are grown extensively on these soils. A considerable acreage of the more eroded and steeper Bratton soils is in forest, or is reverting to forest.

Representative profile of Bratton silt loam, 2 to 6 percent slopes, in a cultivated field 1½ miles northwest of Sinking Spring on State Route 124, 550 yards northwest of the intersection of State Routes 41 and 124, and 100 feet southwest of State Route 124, in Brush Creek Township:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; weak, coarse, subangular blocky structure parting to moderate, medium, granular; friable; many roots; neutral; abrupt, smooth boundary.

B1—10 to 16 inches, brown (7.5YR 4/4) silt loam; weak, medium, subangular blocky structure; friable; common roots; medium, patchy, pale-brown (10YR 6/3) silt coatings on vertical and horizontal ped faces; dark grayish-brown (10YR 4/2) material from the A horizon in isolated pockets and tongues and along old root and worm channels; slightly acid; abrupt, wavy boundary.

IIB21t—16 to 25 inches, reddish-brown (5YR 4/4) clay; moderate, fine and medium, subangular blocky structure; firm; few roots; thin, patchy, brown (7.5YR 4/4) clay films and thick, patchy, light-gray (10YR 7/2) silt coatings on vertical and horizontal ped faces; strongly acid; clear, wavy boundary.

IIB22t—25 to 33 inches, dark reddish-brown (5YR 3/4) clay; weak, coarse, subangular blocky structure parting to strong, fine, angular and subangular blocky; firm; thin, continuous, dark yellowish-brown (10YR 4/4) clay films on vertical and horizontal ped faces; few, medium, prominent, black (10YR 2/1) stains and concretions; 4 percent coarse fragments; medium acid; clear, wavy boundary.

IIB3t—33 to 38 inches, dark-brown (7.5YR 4/4) clay; weak, coarse, subangular blocky structure parting to moderate, fine, angular and subangular blocky; firm; thin, continuous, dark yellowish-brown (10YR 3/4) clay films on vertical and horizontal ped faces; 5 percent coarse fragments; neutral; abrupt, irregular boundary.

IIC—38 to 40 inches, light yellowish-brown (10YR 6/4) sandy loam; massive; very friable; 5 percent coarse fragments; mildly alkaline, calcareous.

IIR—40 inches, limestone bedrock.

The loess mantle is 10 to 22 inches thick. Reaction in the solum ranges from slightly acid to medium acid in the B1 horizon, from medium acid to strongly acid in B2t horizon, and from slightly acid to mildly alkaline in the B3 horizon. The limestone residuum is typically 12 to 28 inches thick. The depth to limestone bedrock ranges from 24 to 40 inches.

The Ap horizon is dark grayish-brown (10YR 4/2) and brown (10YR 4/3 and 5/3). It has a hue of 7.5YR or 5YR in eroded areas. In wooded or other undisturbed areas, there is an A1 horizon that is very dark grayish brown (10YR 3/2), very dark gray (10YR 3/1), or dark gray (10YR 4/1) and is 1 to 4 inches thick.

The B1 horizon is silty clay loam or silt loam, and the B2t and B3t horizons are clay or silty clay. The B1 horizon is brown or dark brown (7.5YR 4/4), dark yellowish brown (10YR 4/3), or yellowish brown (10YR 5/4) and is 4 to 8 inches thick. The B2t horizon has a hue of 5YR, 7.5YR, or 2.5YR, value of 3 to 5, and chroma of 4 to 6. The B3 horizon is dominantly brown or dark brown (7.5YR 4/4) to dark reddish brown (5YR 3/4). Silt coatings of pale brown (10YR 6/3), brown (7.5YR 4/4), or light gray (10YR 7/2) are on ped surfaces in the B1 and upper B2t horizons, The clay films in the B2t and B3t horizons are patchy or continuous, have a hue of 10YR, 7.5YR, or 5YR, value of 3 to 5 and chroma of 3 to 6.

In some profiles there is a C horizon that has a hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 or 4.

Bratton soils, unlike Beasley soils, have hard limestone bedrock within a depth of 40 inches. Bratton soils formed in loess over clayey residuum of limestone bedrock, but Trappist and Muse soils formed in residuum of acid shale bedrock, Markland soils formed in fine-textured lacustrine deposits, and Miamian soils formed in Wisconsin glacial till. Bratton soils do not have the glacial till characteristics of Milton, Grayford, and Boston soils. They are deeper than 20 inches to limestone bedrock, and Opequon soils are shallower than 20 inches to limestone bedrock, Boston and Nicholson soils have a fragipan which Bratton soils lack.

BpB—Bratton silt loam, 2 to 6 percent slopes. This gently sloping soil is on ridgetops in the residual uplands. The ridgetops are 150 to 800 feet wide, slightly convex, and elongated and irregularly shaped. This soil also is in elongated, narrow bands along minor drainageways. It is adjacent to more sloping Bratton or Opequon soils. Slopes are short. Areas cover 5 to 40 acres.

This soil has the profile described as representative of the series. It has few to many sinkholes that range from broad, shallow depressions to small, deep, uncrossable holes. It is free of limestone outcrops and surface fragments.

Included with this soil in mapping is moderately well drained Nicholson silt loam in slight depressions at the head of small waterways, in narrow bands along the waterways, or in small, scattered, concave areas. Also included are moderately eroded spots on the more sloping areas. In these spots the plow layer is a mixture of the original surface layer and the upper part of the subsoil, and the soils are finer textured and are shallower to bedrock. A few areas have limestone at a depth of more than 40 inches.

The hazard of erosion is the main limitation for farming. Shallowness to bedrock and cracks in the underlying limestone are limitations for farm ponds. Shallowness to bedrock, moderately slow permeability, and high shrink-swell potential are major limitations for homesites, septic tank absorption fields, road construction, and many other nonfarm uses. Capability unit IIe–1; woodland suitability group 2c1.

BpB2—Bratton silt loam, 2 to 6 percent slopes, moderately eroded. This gently sloping soil is on ridgetops in the residual uplands. The ridgetops are 150 to 800 feet wide, slightly convex, and elongated and irregularly shaped. A large acreage of this soil is at the head of small drainageways and is in elongated, narrow to medium width bands along minor drainageways where slopes are generally short and convex. This soil is adjacent to more sloping Bratton or Opequon soils. Areas cover 5 to 40 acres.

This soil has a profile similar to the one described as representative of the series, but its plow layer is a mixture of the original surface layer, and the upper part of the subsoil is redder and is somewhat finer textured.

Included with this soil in mapping are moderately well-drained Nicholson soils. Also included are many spots of a severely eroded soil. This soil has a surface layer composed entirely of silty clay or clay loam subsoil material, and shallow gullies and limestone outcrops and rock fragments are common. The soil tends to become hard and cloddy if it is cultivated when too wet. Some slightly eroded areas and sinkholes are also included.

The main limitations for farming are the moderate erosion that has already occurred and the hazard of further erosion if the soil is used for crops. Loss of the surface layer has resulted in a thinner root zone and a lower available water capacity. Because of the many sinkholes and the shallowness to underlying fractured bedrock, this soil is poorly suited for farm ponds and many other nonfarm uses. Capability unit IIe–1; woodland suitability group 2c1.

BpC2—Bratton silt loam, 6 to 12 percent slopes, moderately eroded. This soil is commonly on side slopes along streams and drainageways and on broad, irregularly shaped, low ridges in the uplands. The downhill slopes are generally short, but areas of the soil run laterally along the streams or minor drainageways for several hundred feet. This soil also is commonly upslope from adjoining steeper Opequon soils. Areas range from 1 to 95 acres but are commonly 5 to 20 acres.

This soil has a profile similar to the one described as representative of the series, but its surface layer is a mixture of the original surface layer and subsoil material, is redder, and is somewhat finer textured. There are many sinkholes. Seep areas or wet-season springs are common at the base of slopes.

Included with this soil in mapping are small areas of Nicholson silt loam. Larger areas of more shallow Opequon soils are included, especially on the steeper, more eroded slopes and around sinkholes. Dark-colored soils are in depressions at the head of small waterways, at the base of the slopes, or in narrow bands along drainageways. Also included are severely eroded spots that have some shallow gullies, bedrock outcrops, and fragments of limestone, chert, and geodes. These spots have a surface layer of silty clay loam. During dry seasons many cracks, ⅛ to ½ inch wide, develop in the more eroded areas, and the soil tends to become cloddy and hard if it is cultivated when too wet.

The main limitations for farming are the moderate erosion that has already occurred and the hazard of further erosion if the soil is used for crops. The soil is better suited to pasture and to legume and grass mixtures for hay or silage. Shallowness to rock is a limitation for ponds, homesites, and some other nonfarm uses. Capability unit IIIe–1; woodland suitability group 2c1.

BpD2—Bratton silt loam, 12 to 18 percent slopes, moderately eroded. This moderately steep soil is commonly on side slopes along streams and drainageways and on broad, irregularly shaped, low ridges in the uplands. Downhill slopes are generally short, but areas of the soil run laterally along the streams or minor drainageways for several hundred feet. This soil is commonly upslope from adjoining steeper Opequon soils. Areas cover 3 to 12 acres.

This soil has a profile similar to the one described as representative of the series, but its surface layer is a mixture of the original surface layer and subsoil material, is redder, and is somewhat finer textured. Seep areas or wet-season springs are common at the base of the slopes.

Included with this soil in mapping are shallow Opequon soils and shallow, dark-colored Gasconade soils. The Opequon soils are in depressions, at the base of slopes, or in narrow bands along drainageways. Also included are many severely eroded areas that have bedrock outcrops, shallow gullies, and fragments of limestone, chert, and geodes on the surface. These areas have a surface layer of silty clay loam to clay. Many cracks, ⅛ to ½ inch wide, develop during dry seasons in the severely eroded areas. Many slightly eroded areas where the soil has been in woodland or permanent pasture are also included.

This soil is suited to limited farming, but it is better suited to permanent pasture or woodland because of the slope and erosion. Shallowness to bedrock, slow permeability, high shrink-swell potential, and slope are limitations for homesites and many other nonfarm uses. Capability unit IVe–3; woodland suitability group 2c2.

BrD3—Bratton silty clay loam, 12 to 18 percent slopes, severely eroded. This soil is commonly on side slopes along streams and drainageways and on broad, irregularly shaped, low ridges in the uplands. Downhill slopes are generally short, but areas of the soil run laterally along the streams or minor drainageways for several hundred feet. This soil is commonly upslope from adjoining steeper Opequon soils. Areas cover 3 to 12 acres.

This soil has a profile similar to the one described as representative of the series, but its surface layer is chiefly subsoil material, is redder, and is silty clay loam or clay rather than silt loam. Seep areas or wet-season springs are common at the base of the slopes.

Included with this soil in mapping are areas of shallow Opequon soils and shallow, dark-colored Gasconade soils. The more eroded, steeper Opequon soils are around sinkholes, and the Gasconade soils are in depressions, at the base of slopes, or in narrow bands along drainageways. Also included are many severely eroded areas that have bedrock outcrops, shallow gullies, and fragments of limestone, chert, and geodes on the surface. Numerous cracks, ⅛ and ½ inch wide, develop during dry seasons in the more severely eroded areas. Many slightly eroded areas are included where the soil has been in woodland or permanent pasture.

This soil is sticky when wet and hard when dry. It is so severely eroded that cultivation is generally not practical. Bedrock is nearer the surface than in other Bratton soils; it is general y at a depth of 20 to 30 inches. This soil is poorly suited to most farm and nonfarm uses. It is better suited to permanent pasture or woodland. Capability unit VIe–2; woodland suitability group 2c2.

Brookston Series

The Brookston series consists of dark-colored, nearly level to depressional soils that are very poorly drained. These soils formed in loamy glacial till of Wisconsin Age. They are on uplands. The native vegetation was hardwood forest in which maple, ash, elm, and swamp oaks were dominant.

In a representative profile in a cultivated area, the plow layer is very dark brown silty clay loam 8 inches thick. The layer below that black silty clay loam 10 inches thick. The subsoil extends to a depth of 60 inches. The upper 15

inches is dark-gray to grayish-brown clay mottled with yellowish brown. The lower 27 inches is gray and yellowish-brown loam. The substratum is dark yellowish-brown, calcareous clay loam to a depth of 65 inches.

The available water capacity is high in Brookston soils. Permeability is moderately slow, and surface runoff is slow to ponded. The water table is high during wet seasons. The root zone is deep and is commonly slightly acid to mildly alkaline.

Brookston soils are used mostly for corn, soybeans, and wheat, and some areas are used for grass-legume mixtures for hay and meadow. A small acreage is in permanent pasture or woodlots.

Representative profile of Brookston silty clay loam, in a cultivated field 2¼ miles north-northwest of Greenfield on Martinsburg Road East, ¼ mile west of Bonner Road, 350 yards south of Fayette County line, and 100 yards north of Martinsburg Road East, in Madison Township:

Ap—0 to 8 inches, very dark brown (10YR 2/2) silty clay loam, very dark grayish brown (10YR 3/2) when rubbed; moderate, fine, subangular blocky structure; friable; many roots; less than 2 percent pebbles; mildly alkaline; abrupt, smooth boundary.

A12—8 to 18 inches, black (10YR 2/1) silty clay loam, very dark brown (10YR 2/2) when rubbed; common, fine, distinct, brown (10YR 4/3) mottles; moderate, medium, prismatic structure parting to strong, medium, subangular blocky; firm; common roots; less than 2 percent pebbles; slightly acid; clear, wavy boundary.

IIB1tg—18 to 23 inches, dark-gray (10YR 4/1) clay; common, fine and medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky; firm; common roots; thin, patchy, very dark gray (N 3/0) clay films on vertical and horizontal ped faces; less than 5 percent pebbles; slightly acid; clear, irregular boundary.

IIB21tg—23 to 33 inches, grayish-brown (10YR 5/2) clay; many, medium, distinct, yellowish-brown (10YR 5/4 and 5/6) mottles; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky; firm; few roots; thin, continuous, very dark gray (10YR 3/1) and dark-gray (10YR 4/1) clay films on vertical ped faces and thin very patchy clay films on horizontal ped faces; 7 percent pebbles; neutral; clear, irregular boundary.

IIB22tg—33 to 49 inches, gray (10YR 6/1) and yellowish-brown (10YR 5/6) clay loam; weak, medium, prismatic structure parting to weak, medium, subangular blocky; firm; thin, very patchy, dark grayish-brown (10YR 4/2) and very dark gray (10YR 3/1) clay films on vertical ped faces; 7 percent pebbles; mildly alkaline: gradual, wavy boundary.

IIB3g—49 to 60 inches, gray (10YR 6/1) and yellowish-brown (10YR 5/6) clay loam; weak, coarse, subangular blocky structure; friable; 7 percent pebbles; moderately alkaline; clear, irregular boundary.

IIC—60 to 65 inches, dark yellowish-brown (10YR 4/4) clay loam; few, coarse, distinct, very dark gray (10YR 3/1) mottles; massive; friable; 10 percent pebbles; mildly alkaline, calcareous.

The solum ranges from 34 to 65 inches in thickness, but typically is 40 to 50 inches thick. The loess mantle is 0 to 20 inches thick. Reaction in the solum ranges from slightly acid to moderately alkaline.

The A horizon is silty clay loam or silt loam. It is most commonly 12 to 18 inches thick, but it ranges from 10 to 26 inches in thickness. The A horizon is black (10YR 2/1) to very dark grayish brown (10YR 3/2).

The IIB1t horizon ranges from dark gray (10YR 4/1) to gray (10YR 5/1) and has mottles in a hue of 10YR or 7.5YR, value of 4 through 6, and chroma of 4 through 6. The IIB2t and IIB3t horizons are dark gray (N 4/0) to grayish brown (10YR 5/2) and have mottles in a hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 4 through 6. The IIB1t and IIB2t horizons range from clay loam to clay, the IIB3 horizon ranges from silty clay loam to loam, and the IIC horizon ranges from clay loam to loam.

The Brookston soils in Highland County have a higher clay content in the upper part of the B horizon than is defined in the range for the series. This difference, however, does not alter their usefulness of behavior.

Brookston soils are a part of two drainage sequences. One includes well drained Miamian soils, moderately well drained Celina soils, and somewhat poorly drained Crosby soils, and the other includes well drained Russell soils, moderately well drained Xenia soils, and somewhat poorly drained Fincastle soils. Brookston soils contain more clay in their B horizon and are less acid than Patton soils. They have a C horizon of loamy glacial till, but Patton soils are underlain by silty sediment, Westland soils by sand and gravel, Millsdale soils by limestone bedrock, and Montgomery soils by clayey sediment. Brookston soils are very poorly drained, and Dana soils are moderately well drained.

Bs—Brookston silt loam. This nearly level to depressional, dark-colored soil is in broad areas, in fan-shaped areas at the head of drainageways, and in narrow strips along waterways. Where this dark-colored soil is on the Reesville end moraine, it is adjacent to light-colored Miamian, Celina, and Crosby soils. South of the Reesville end moraine, it is next to Miamian-Russell, Celina-Xenia, and Crosby-Fincastle complexes. Areas range from 2 to 70 acres, but most are 3 to 20 acres. On the Reesville end moraine, areas generally cover 2 to 6 acres.

This soil has a profile similar to the one described as representative of the series, but its surface layer contains less clay. The silt loam surface layer of this soil is easier to till and is less likely to become cloddy than Brookston silty clay loam.

Included with this soil in mapping are Crosby soils and small isolated knolls of Celina silt loam, 2 to 6 percent slopes. Dark-colored, moderately well drained Dana soils are commonly included in transitional or more sloping border areas near better drained soils.

Wetness is a moderate limitation for farming. The soil is also subject to seepage, ponding, and deposition of inwash material from surrounding soils. These are also limitations for most nonfarm uses. Capability unit IIw–4; woodland suitability group 2w1.

Bt—Brookston silty clay loam. This nearly level to depressional, dark-colored soil is in broad areas, fan-shaped areas at the head of drainageways, and narrow strips along waterways. Areas are generally 2 to 50 acres; however, near New Vienna, areas are as large as 500 acres and extend into the adjoining county. Where this dark-colored soil is on the Reesville end moraine, it is adjacent to light-colored Miamian, Celina, and Crosby soils. South of the Reesville end moraine, it is next to Miamian-Russell, Celina-Xenia, and Crosby-Fincastle complexes. This soil has the profile described as representative of the series.

Included with this soil in mapping are Crosby soils and small isolated knolls of Celina silt loam, 2 to 6 percent slopes. A few areas that have either a thinner or thicker dark-colored surface layer than the one described in the representative profile are also included. Dark-colored, moderately well drained Dana soils are commonly included in transitional or more sloping border areas near better drained soils.

Wetness is the main limitation of this soil for farming. The soil is subject to seepage from surrounding areas, and depressional or concave areas are subject to surface ponding of long duration. If the soil is plowed when too

wet, the surface layer is likely to be cloddy. Wetness, moderately slow permeability, a seasonal high water table, surface ponding, and a high shrink-swell potential are limitations for homesites, septic tank absorption fields, and other nonfarm uses. Capability unit IIw–4; woodland suitability group 2w1.

Cana Series

The Cana series consists of moderately well drained to well drained, gently sloping to very steep soils on uplands. These soils formed mainly in loess and the underlying Illionoian glacial till over shale bedrock. The native vegetation was hardwood forest in which oak, beech, maple, and yellow-poplar were dominant.

In a representative profile, the plow layer is dark grayish-brown silt loam 9 inches thick. The subsurface layer is brown and dark grayish-brown heavy silt loam 4 inches thick. The subsoil extends to a depth of 43 inches. The upper 5 inches is brown silty clay loam. The next 10 inches is brown clay loam. The next 8 inches is strong-brown clay loam that has light brownish-gray mottles. The lower 7 inches is brown silty clay that has light-gray and yellowish-red mottles. The substratum is light brownish-gray, strong-brown, and reddish-brown clay that extends to a depth of 55 inches. Shale bedrock is below that.

The available water capacity is medium in Cana soils. Permeability is slow, and surface runoff is medium to rapid. The root zone is moderately deep and is neutral to very strongly acid.

Cana soils are used mainly for permanent pasture and woodland. Some corn, small grains, and grass-legume mixtures for hay and pasture are grown on the gently sloping and sloping Cana soils.

Representative profile of Cana silt loam, 2 to 6 percent slopes, 2¾ miles south-southeast of Rainsboro, 3¾ miles northeast of Carmel, 660 yards north-northwest of the intersection of Barrett Mill Road and Brier Hill Road, and 100 feet east and 100 feet south of Brier Hill Road, in Paint Township:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; friable; many roots; few pebbles; neutral; abrupt, smooth boundary.

A2—9 to 13 inches, brown (7.5YR 4/4) and dark grayish-brown (10YR 4/2) heavy silt loam; moderate, fine, subangular blocky structure parting to moderate, medium, granular; friable; many roots; few pebbles; slightly acid; clear, wavy boundary.

IIB1t—13 to 18 inches, brown (7.5YR 4/4) silty clay loam; moderate, fine and medium, subangular blocky structure; friable; common roots; thin, very patchy, yellowish-brown (10YR 5/4) clay films on vertical and horizontal ped faces; dark grayish-brown (10YR 4/2) organic stains on some ped faces and in old root channels; 5 percent pebbles; medium acid; clear, wavy boundary.

IIB21t—18 to 23 inches, brown (7.5YR 4/4) clay loam; strong, medium, subangular blocky structure; firm; common roots; thin, patchy, yellowish-brown (10YR 5/4) and brown (7.5YR 5/4) clay films on vertical and horizontal ped faces; dark grayish-brown (10YR 4/2) stains and coatings in old root channels; 8 percent pebbles; strongly acid; gradual, wavy boundary.

IIB22t—23 to 28 inches, brown (7.5YR 4/4) clay loam; strong, medium, subangular blocky structure; firm; common roots; thin, patchy, yellowish-brown (10YR 5/4) and brown (7.5YR 5/4) clay films on vertical and horizontal ped faces; grayish-brown (10YR 5/2) stains and coatings in old root channels; common, fine, prominent, black (10YR 2/1) stains and concretions; 10 percent pebbles; strongly acid; clear, wavy boundary.

IIB23t—28 to 36 inches, strong-brown (7.5YR 5/6) clay loam; common, fine, prominent, light brownish-gray (2.5YR 6/2) mottles; strong, fine and medium, subangular blocky structure; firm; few roots; thin, patchy, reddish-brown (5YR 4/4) and yellowish-brown (10YR 5/4) clay films on vertical and horizontal ped faces; common, fine, prominent, black (10YR 2/1) stains and concretions; 10 percent pebbles; very strongly acid; clear, smooth boundary.

IIIB3t—36 to 43 inches, brown (7.5YR 4/4) silty clay; common, medium, prominent, light-gray (10YR 7/1) mottles and common, fine, prominent, yellowish-red (5YR 4/6) mottles; weak, medium, subangular blocky structure; firm; common, fine, prominent, black (10YR 2/1) stains and concretions; 20 percent pebbles; very strongly acid; gradual, smooth boundary.

IIIC—43 to 55 inches, light brownish-gray (10YR 6/2), strong-brown (7.5YR 5/6), and reddish-brown (5YR 4/4) clay; moderate, medium, platy structure; very firm; shale fragments of gray (10YR 6/1), dark gray (10YR 4/1), and very dark grayish brown (10YR 3/2); extremely acid.

IIIR—55 inches, shale bedrock.

The solum is 30 to 60 inches thick. The loess cap ranges from 0 to 18 inches in thickness, but is typically 6 to 14 inches thick. Reaction in the Ap horizon through the IIB2t horizon is neutral to very strongly acid, and in the B3 horizon and C horizon is strongly acid to extremely acid.

The Ap horizon is dark grayish brown (10YR 4/2), brown (10YR 5/3), or dark brown (10YR 4/3). In wooded areas and other undisturbed areas, there is an A1 horizon that is very dark grayish brown (10YR 3/2) or very dark brown (10YR 2/2) and is 1 to 4 inches thick. There is also a brown (7.5YR 5/4 and 4/4) or yellowish-brown (10YR 5/4) A2 horizon 2 to 6 inches thick.

The B1t and B2t horizons are 10 to 36 inches thick. They are heavy silt loam, silty clay loam, or clay loam. The B1t and B2t horizons are mainly brown or dark brown (7.5YR 4/4 and 5/4), yellowish brown (10YR 5/4 and 5/6), or strong brown (7.5YR 5/6).

The IIIC horizon is brown (10YR 4/3), light brownish gray (10YR 6/2), strong brown (7.5YR 5/6), and reddish brown (5YR 4/4).

Cana soils formed in loess and the underlying glacial till, and Muse and Trappist soils formed in shale residuum. Cana soils are underlain by acid shale bedrock, and Loudon and Jessup soils are underlain by calcareous shale bedrock.

CaB—Cana silt loam, 2 to 6 percent slopes. This gently sloping soil is on Illinoian glaciated toe slopes of the Allegheny Plateau and on some of the ridgetops in the Wisconsin glaciated part of the county. Some areas of this soil are narrow to broad and oval or rounded to irregularly shaped, but most are elongated. They range from 3 to 25 acres, but most are 3 to 15 acres. Slopes are medium in length and are convex.

This soil is near Miamian and Celina soils in the Wisconsin glaciated area. It is near gently sloping or steeper Colyer and Trappist soils on the Illinoian glaciated toe slopes of the Allegheny Plateau. It commonly joins Rossmoyne soils. This soil has the profile described as representative of the series.

Included with this soil in mapping, mainly in the Wisconsin glaciated area, are some moderately eroded Cana soils.

The hazard of erosion is moderate if this soil is farmed. Slow permeability, shallowness to shale bedrock, and moderate shrink-swell potential are limitations for many nonfarm uses. Capability unit IIe–4; woodland suitability group 3o1.

CaC2—Cana silt loam, 6 to 12 percent slopes, moderately eroded. This soil is on somewhat dissected toe slopes

on the Allegheny Plateau and on side slopes in the glaciated part of the county. The side slopes may be convex or concave. Areas range from 2 to 40 acres, but most are 3 to 15 acres. This soil has a profile similar to the one described as representative of the series, but the plow layer is partly material from the upper part of the subsoil, is browner, and contains less loess.

Included with this soil in mapping are areas that are slightly eroded and small areas of Miamian and Rossmoyne soils in the Wisconsin and Illinoian glaciated areas. Scattered small, severely eroded spots are also included.

The hazard of erosion is severe if this soil is used for crops. Slow permeability and shallowness to shale bedrock are limitations for most nonfarm uses. Capability unit IIIe-5; woodland suitability group 3o1.

CaD2—Cana silt loam, 12 to 18 percent slopes, moderately eroded. This soil is in cleared and wooded areas on dissected, glaciated toe slopes on the Allegheny Plateau. Areas of this soil are broad and rounded to irregularly shaped, but most are elongated and are on ridgetops between other steeply dissected Cana soils. They range from 3 to 12 acres. This soil is near steeper Colyer-Trappist complexes.

This soil has a profile similar to the one described as representative of the series, but nearly half of its original surface layer has been removed through erosion. The remaining part of the plow layer is subsoil material.

Included with this soil in mapping are small areas of Miamian or Rossmoyne soils. Near the Miamian soils, this soil is slightly less acid throughout the profile than near the Rossmoyne soils.

Moderately steep slopes, erosion, moderate to low natural fertility, and the very high lime requirement are severe limitations of this soil for crops. Shallowness to shale bedrock, slow permeability, moderate shrink-swell potential, and slope are limitations for nonfarm uses. Capability unit IVe-5; woodland suitability group 3r1.

CaF—Cana silt loam, 18 to 35 percent slopes. This soil is generally in somewhat elongated areas adjacent to drainageways in dissected toe slopes on the Allegheny Plateau. Areas generally range from 3 to 15 acres, but one area is 60 acres.

Included with this soil in mapping are small areas of Colyer-Trappist complexes and Hickory soils. Small areas of moderately eroded Cana soils are also included.

More than half the acreage of this soil is wooded. The rest has been cleared and cultivated but now is reverting to trees or is kept in permanent grass. This soil is best suited to woodland. Slope, the severe hazard of erosion when cleared of vegetation, and shallowness to bedrock are severe limitations for almost all other uses. Capability unit VIe-3; woodland suitability group 3r1.

Casco Series

The Casco series consists of well-drained, moderately steep to steep soils that are shallow to sand and gravel. Casco soils formed in outwash material that overlies layers of calcareous sand and gravel of Wisconsin Age. They are on dissected outwash plains, high stream terraces, valley trains, and glacial kames. The native vegetation was hardwood forest in which oak and hickory were dominant.

In a representative profile in a farmed area, the surface layer is dark grayish-brown gravelly loam 4 inches thick. The subsoil is brown gravelly loam in the upper 2 inches. Below that, to a depth of 20 inches, it is firm, dark-brown gravelly clay loam that grades to gravelly sandy clay loam in the lower part. The substratum is friable, yellowish-brown, gravelly sandy loam that grades to loose, yellowish-brown sand and gravel below a depth of 40 inches.

The available water capacity is low in Casco soils. Permeability is moderate to moderately rapid in the surface layer and subsoil and is moderately rapid to rapid in the gravelly substratum. The root zone is shallow and is commonly neutral to medium acid.

Casco soils are used mainly for hay and pasture. A large acreage of the steeper Casco soils is in forest. A small part of the cleared acreage is idle and is reverting to forest.

Representative profile of Casco gravelly loam, 18 to 35 percent slopes, moderately eroded, in a cultivated field 1¾ miles south-southeast of Centerfield, 75 yards east of Cope Road, and 75 yards south of barn, in Paint Township:

Ap—0 to 4 inches, dark grayish-brown (10YR 4/2) gravelly loam; moderate, fine and medium, granular structure; friable; many roots; 5 percent vesicular pores; 15 percent pebbles; neutral; abrupt, wavy boundary.

B1t—4 to 6 inches, brown (10YR 4/3) gravelly loam; moderate, fine and medium, subangular blocky structure; friable; common roots; 5 percent tubular pores; thin, very patchy, dark grayish-brown (10YR 4/2) clay films on vertical and horizontal ped faces; 20 percent pebbles; slightly acid; clear, wavy boundary.

B21t—6 to 10 inches, dark-brown (7.5YR 4/4) gravelly clay loam; moderate, medium, subangular blocky structure; firm; few roots; 10 percent tubular pores; thin, very patchy, brown (7.5YR 4/2) clay films on vertical and horizontal faces; 25 percent pebbles; slightly acid; clear, wavy boundary.

B22t—10 to 16 inches, dark-brown (7.5YR 4/4) gravelly clay loam; moderate, fine and medium, subangular blocky structure; firm; few roots; 10 percent tubular pores; medium, patchy, brown (7.5YR 4/2) and dark-brown (7.5YR 3/2) clay films on vertical and horizontal ped faces; 35 percent pebbles; slightly acid; clear, wavy boundary.

B23t—16 to 20 inches, dark-brown (7.5YR 4/4) gravelly sandy clay loam; moderate, fine and medium, subangular blocky structure; firm; few roots; 10 percent tubular pores; medium, patchy, brown (7.5YR 4/2) and dark-brown (7.5YR 3/2) clay films on vertical and horizontal ped faces; 35 percent pebbles; neutral; clear, wavy boundary.

IIC1—20 to 40 inches, yellowish-brown (10YR 5/4) gravelly sandy loam; massive; friable; 45 percent pebbles; mildly alkaline, calcareous; clear, irregular boundary.

IIC2—40 to 60 inches, yellowish-brown (10YR 5/4) sand and gravel; single grained; loose; mildly alkaline, calcareous.

The Ap or A1 horizon is dark grayish brown (10YR 4/2) brown (10YR 4/3), or yellowish brown (10YR 5/4).

The B1t and B2t horizons are dark brown (10YR 4/3 and 7.5YR 4/4), brown (10YR 5/3 and 7.5YR 4/2 and 5/4), or yellowish brown (10YR 5/4). The B1t and B2t horizons are 25 to 50 percent sand.

The upper part of the B1t and B2t horizons is slightly acid or neutral, but in some places the lower part is mildly alkaline. The B2t horizon is gravelly clay loam, sandy loam, or gravelly sandy clay loam 5 to 16 inches thick. The depth to free carbonates ranges from 10 to 24 inches.

The C horizon is massive gravelly sandy loam or single grained, poorly sorted to well-sorted, calcareous sand and gravel.

Casco soils are part of the drainage sequence that includes well-drained Fox soils. Casco soils have a thinner B2t horizon and are shallower to calcareous sandy and gravelly outwash than Fox soils. They have more clay in the solum and are shallower to sand and gravel than Stonelick soils. They have a much thinner solum, a less developed profile, and a much

higher base saturation than Negley soils, and they are not so deeply leached. Casco soils formed in loamy outwash material over calcareous sand and gravel, but Kendallville soils lack the calcareous sand and gravel substratum.

CcD3—Casco gravelly loam, 12 to 18 percent slopes, severely eroded. This moderately steep soil is on terraces and in narrow, elongated bands along streams and minor drainageways. It is also on irregularly shaped, gravelly hillsides of glacial kames, eskers, and moraines in the uplands. Areas range from 5 to 15 acres. Fox, Ockley, and Miamian soils are on adjacent higher areas, and Fox and Ockley soils are on adjacent downslope terraces.

This soil has a profile similar to the one described as representative of the series, but the surface layer is mostly of subsoil material and is more gravelly. Limy sand and gravel are exposed in many places. This soil is more droughty than other Casco gravelly loams. There are many small, shallow gullies. A few of the deeper gullies cannot be crossed with farm equipment.

Included with this soil in mapping in the uneroded, wooded areas are soils that have a dark surface layer.

Slope, severe erosion, and droughtiness are limitations for farming and for nonfarm uses. Capability unit VIe–1; woodland suitability group 3f1.

CcF2—Casco gravelly loam, 18 to 35 percent slopes, moderately eroded. This steep to very steep soil is on terraces and in narrow, elongated bands along streams and minor drainageways. It is also on irregularly shaped, gravelly hillsides of glacial kames, eskers, and moraines in the uplands. Areas range from 5 to 15 acres. Fox, Ockley, and Miamian soils are on adjacent higher areas, and Fox and Ockley soils are on adjacent downslope terraces.

This soil has the profile described as representative of the series. Its surface layer is a mixture of the original surface layer and the upper part of the subsoil. It is somewhat coarser textured, more gravelly, and lighter colored than uneroded Casco soils in wooded areas.

Included with this soil in mapping in uneroded wooded areas are soils that have a dark surface layer. Also included are some small areas that are severely eroded and contain small gullies. These areas have a very gravelly, sandy surface layer, and limy sand and gravel is exposed.

Slope, erosion, and droughtiness are limitations for farming and for nonfarm uses. Capability unit VIIe–1; woodland suitability group 3f1.

Celina Series

The Celina series consists of moderately well drained, nearly level to gently sloping soils that formed in thin loess and underlying Wisconsin Age glacial till. The Celina soils are on loess mantled glacial till plains. The native vegetation was hardwood forest in which maple, beech, oak, and hickory were dominant.

In a representative profile in a cultivated area, the surface layer is brown silt loam 7 inches thick. The subsoil extends to a depth of 39 inches. The upper 9 inches is yellowish-brown silty clay loam. The next 6 inches is dark yellowish-brown silty clay that has grayish-brown and yellowish-brown mottles. The next 8 inches is dark yellowish-brown clay that has light brownish-gray and yellowish-brown mottles. The lower 9 inches is yellowish-brown clay loam that has yellowish-brown, light brownish-gray, and dark grayish-brown mottles. The substratum is yellowish-brown loam that has light brownish-gray and yellowish-brown mottles and extends to a depth of 60 inches.

The available water capacity is medium in Celina soils. Permeability is moderately slow, and surface runoff is slow to medium. The root zone is moderately deep and is commonly neutral to very strongly acid.

Celina soils are used mainly for corn, soybeans, wheat, and grass-legume mixtures for hay and pasture. A small acreage is in permanent pasture or woodland.

Representative profile of Celina silt loam, 2 to 6 percent slopes, in a cultivated field 2¾ miles northeast of Greenfield on Martinsburg Road East, ½ mile south of the intersection of Limes Road and Martinsburg Road East, and 85 yards east of Limes Road, in Madison Township:

Ap—0 to 7 inches, brown (10YR 4/3) silt loam; weak, medium, granular structure; very friable; many roots; few pebbles; abrupt, smooth boundary.

B1—7 to 10 inches, yellowish-brown (10YR 5/4) silty clay loam; weak, medium, subangular blocky structure; friable; common roots; few pebbles; very strongly acid; clear, wavy boundary.

IIB21t—10 to 16 inches, yellowish-brown (10YR 5/4) silty clay loam; moderate, fine and medium, subangular blocky structure; firm; few roots; thin, very patchy, brown (10YR 4/3) clay films on vertical and horizontal ped faces; thin, patchy, brown (10YR 5/3) and very pale brown (10YR 7/3), dry silt coatings on vertical ped faces; 4 percent pebbles; very strongly acid; gradual, wavy boundary.

IIB22t—16 to 22 inches, dark yellowish-brown (10YR 4/4) silty clay; common, medium, distinct, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/6) mottles; strong, medium, subangular and angular blocky structure; firm; few roots; thin, patchy, brown (10YR 4/3) clay films on vertical and horizontal ped faces; thin, patchy, brown (10YR 5/3) and very pale brown (10YR 7/3), dry silt coatings on vertical and horizontal ped faces; common, prominent, black (10YR 2/1) stains and concretions; 4 percent pebbles; medium acid; clear, wavy boundary.

IIB23t—22 to 30 inches, dark yellowish-brown (10YR 4/4) clay; common, medium, distinct, light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/6) mottles; moderate, medium, prismatic structure parting to strong, medium, angular, and subangular blocky; firm; few roots; thin, patchy, dark yellowish-brown (10YR 3/4) clay films on horizontal ped faces and medium, continuous, dark yellowish-brown, (10YR 3/4) clay films on vertical ped faces; common fine, prominent, black (10YR 2/1) stains and concretions; 4 percent pebbles; slightly acid; clear, wavy boundary.

IIB3t—30 to 39 inches, yellowish-brown (10YR 5/4) clay loam; few, fine, distinct, yellowish-brown (10YR 5/8) mottles and common, medium, distinct, light brownish-gray (10YR 6/2) and dark grayish-brown (10YR 4/2) mottles; weak, coarse, subangular blocky structure; firm; few roots; thin, patchy, dark yellowish-brown (10YR 3/4) clay films on vertical ped faces; few, fine, prominent, black (10YR 2/1) stains and concretions; 10 percent pebbles; mildly alkaline, calcareous in isolated spots; gradual, wavy boundary.

IIC—39 to 60 inches, yellowish-brown (10YR 5/4) loam; common, medium, distinct, light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/8) mottles; massive; firm and compact; 15 percent pebbles; mildly alkaline, calcareous.

The thickness of the solum and the depth to calcareous till is 20 to 40 inches. The loess cap is 0 to 18 inches thick. Reaction in the solum is medium acid to neutral in the A horizon, very strongly acid to neutral in the upper part of the B horizon, and slightly acid to mildly alkaline in the lower part of the B horizon.

The Ap horizon is dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), or brown (10YR 4/3). Profiles in undisturbed areas have an A1 horizon, 1 to 4 inches thick, that is very dark grayish brown (10YR 3/2) or black (10YR 2/1).

The B1 horizon is mainly yellowish brown (10YR 5/4 and 5/6). The B2 horizon has a hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4. The B1 and B2t horizons are silty clay loam, silty clay, and clay. Clay films on ped faces in the B2t horizon are dark grayish brown (10YR 4/2), brown (10YR 4/3), or dark yellowish brown (10YR 3/4). Mottles have a hue of 10YR, value of 5 or 6, and chroma of 2 through 8.

The C horizon is yellowish brown (10YR 5/4) or brown (10YR 5/3).

Celina soils are part of the drainage sequence that includes well-drained Hennepin and Miamian soils, somewhat poorly drained Crosby soils, and very poorly drained Brookston soils. Celina soils have a thinner loess cap and are shallower to calcareous till than Xenia soils. They have a higher clay content in the B2t horizon than the Xenia soils. Celina soils are underlain by glacial till, and Markland soils are underlain by lacustrine material. They lack the calcareous shale residuum and bedrock underlying the Loudon soils.

CeB—Celina silt loam, 2 to 6 percent slopes. This gently sloping soil is in broad areas that lie between Miamian and Crosby soils, in areas along minor drainageways, and on some long, narrow ridgetops in the somewhat dissected uplands. Most slopes are slightly concave but some are slightly convex, and they vary in length and width. Areas generally range from 3 to 30 acres, but some are as large as 50 acres.

This soil has the profile described as representative of the series. In most places only a little of the original surface layer has been removed through erosion. In a few areas the surface layer is thicker than in the profile described as representative of the series because it is covered by an inwash of silty material from surrounding soils.

Included with this soil in mapping are small areas of better drained, gently sloping Miamian soils and some wetter Crosby soils and dark-colored Brookston soils in slight depressions.

The hazard of erosion is moderate if this soil is cultivated. Moderately slow permeability and a seasonal high water table are limitations for some nonfarm uses. Capability unit IIe–1; woodland suitability group 2o1.

CfB—Celina-Urban land complex, gently sloping. This gently sloping complex consists of areas where grading and digging have destroyed or covered the original soil. Most of this unit is used for urban development. It is mainly in and near Leesburg. Disturbed areas make up 35 to 50 percent of the complex. Undisturbed Celina soils are in such places as undeveloped lots, playgrounds, back parts of developed lots, and small patches of woodland.

About 1 to 3 feet of fill material overlies undisturbed Celina soils. The fill material is clay loam and clay subsoil material and calcareous loam substratum material from nearby borrow areas of Miamian, Celina, and other soils.

Included with this soil in mapping are Xenia soils and small areas of Miamian, Russell, Crosby, and Fincastle soils.

The surface layer of the disturbed areas commonly has a low organic-matter content and is in poor physical condition. Seed germination is usually poor. The hazard of erosion is severe, particularly in construction areas that are without plant cover. Capability unit and woodland suitability group not assigned.

CgA—Celina-Xenia silt loams, 0 to 2 percent slopes. These nearly level soils are in broad, slightly concave, transitional areas between the gently sloping Miamian-Russell complex and either the nearly level Crosby-Fincastle complex or Brookston soils. Some small areas are at the head of small, crossable waterways. Areas commonly range from 3 to 15 acres. About 50 percent of this complex is Celina soils, and 40 percent is Xenia soils.

These soils have a thicker surface layer than the profiles described as representative of the Celina and Xenia series, because they receive inwash from surrounding soils.

Included with these soils in mapping are Crosby-Fincastle silt loams and Brookston silt loam along small waterways and in small, slight depressions.

These soils have few limitations for farming. The included soils are wet and may need to be drained. The moderately slow permeability and a seasonal high water table are limitations for many nonfarm uses. Capability unit I–1; woodland suitability group 2o1.

CgB—Celina-Xenia silt loams, 2 to 6 percent slopes. These gently sloping soils are in broad areas along minor drainageways where slopes are long to short and on some long, narrow ridgetops in the somewhat dissected uplands. Most slopes are slightly concave, but many are slightly convex and vary in length and width. Areas generally range from 3 to 30 acres. About 55 percent of this complex is Celina soils, and 35 percent is Xenia soil. The Xenia soil in this complex has the profile described as representative of the Xenia series.

Included with these soils in mapping are some small, oval or rounded humps or knolls of Miamian-Russell complexes and some wetter Crosby-Fincastle complexes and dark-colored Brookston soils along the small, crossable drainageways.

The hazard of erosion is moderate if this complex is cultivated. The moderately slow permeability and a seasonal high water table are limitations for some nonfarm uses. Capability unit IIe-1; woodland suitability group 2o1.

Cincinnati Series

The Cincinnati series consists of well-drained, gently sloping to moderately steep soils that formed in loess and the underlying Illinoian glacial till. The Cincinnati soils are on dissected, loess-mantled glacial till plains. The native vegetation was hardwood forest in which oak, hickory, beech, maple, and yellow-poplar were dominant.

In a representative profile in a cultivated area, the surface layer is brown silt loam 10 inches thick. The subsoil extends to a depth of 90 inches. The upper 6 inches is dark yellowish-brown silt loam. The next 12 inches is yellowish-brown silty clay loam. The next 7 inches is yellowish-brown loam. The next 17 inches is yellowish-brown, firm and brittle clay loam that has yellowish-brown, light brownish-gray, and gray mottles. The next 6 inches is yellowish-brown clay loam that has gray mottles. The lower 32 inches is yellowish-brown clay loam that has light brownish-gray and grayish-brown mottles. The substratum, to a depth of 115 inches, is yellowish-brown loam that has lighter yellowish-brown mottles.

The available water capacity is medium to high in Cincinnati soils. Permeability is moderately slow, and surface runoff is medium to very rapid. The root zone is moderately deep and is strongly acid to very strongly acid.

Cincinnati soils are used mainly for corn, wheat, soybeans, and grass-legume mixtures for hay and pasture. A moderate acreage is used for permanent pasture and woodland, and a small acreage is idle.

Representative profile of Cincinnati silt loam, 2 to 6 percent slopes, 4½ miles south-southwest of Hillsboro, 0.7 mile south of the intersection of Griffith and Swisshelm Roads, ¼ mile north of Warlamount Road, and 125 yards east of Swisshelm Road in New Market Township:

Ap—0 to 10 inches, brown (10YR 4/3) silt loam; moderate, fine and medium, granular structure; friable; many fine roots; strongly acid; abrupt, smooth boundary.

B1—10 to 16 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, fine and medium, subangular blocky structure; friable; many fine roots; strongly acid; clear, wavy boundary.

B21t—16 to 28 inches, yellowish-brown (10YR 5/6) light silty clay loam; moderate, fine and medium, subangular blocky structure; friable; common fine roots; thin, patchy, dark yellowish-brown (10YR 4/4) clay firms; few, fine, very dark brown (10YR 2/2) stains; strongly acid; clear, wavy boundary.

IIB22t—28 to 35 inches, yellowish-brown (10YR 5/6) heavy loam; moderate, medium, subangular blocky structure; firm; few fine roots; thin, patchy, dark yellowish-brown (10YR 4/4) clay films; few, fine, very dark brown (10YR 2/2) stains and concretions; 3 percent glacial pebbles; strongly acid; clear, wavy boundary.

IIBx1—35 to 45 inches, yellowish-brown (10YR 5/4) light clay loam; common, medium, faint, yellowish-brown (10YR 5/6) mottles and common, medium, distinct, light brownish-gray (10YR 6/2) mottles; moderate, very coarse, prismatic structure parting to weak, medium, subangular blocky; firm, brittle; few fine roots along faces of prisms; thin, continuous, light yellowish-brown (10YR 6/4) silt coatings on prism faces; medium, continuous, dark yellowish-brown (10YR 4/4) clay films on vertical ped faces and thin, patchy, brown (10YR 5/3) clay films on horizontal ped faces; few, fine, very dark brown (10YR 2/2) stains and concretions; 8 percent glacial pebbles; strongly acid; clear, wavy boundary.

IIBx2—45 to 52 inches, yellowish-brown (10YR 5/4) light clay loam; many, medium, distinct, yellowish-brown (10YR 5/8) mottles and few, medium, distinct, yellowish-brown (10YR 5/8) and gray (10YR 6/1) mottles; moderate, very coarse, prismatic structure parting to weak, medium, subangular blocky; firm, brittle; thin, patchy, light yellowish-brown (10YR 6/4) silt coatings on prism faces; medium, patchy, dark yellowish-brown (10YR 4/4) clay films on vertical ped faces and thin, very patchy, brown (10YR 5/3) clay films on horizontal ped faces; few, fine, very dark brown (10YR 2/2) stains and concretions; 8 percent glacial pebbles; strongly acid; clear, wavy boundary.

IIB31t—52 to 58 inches, yellowish-brown (10YR 5/6) clay loam; few, medium, distinct, gray (10YR 6/1) mottles; weak, coarse, prismatic structure parting to weak, coarse, subangular blocky; firm; thin, very patchy, light yellowish-brown (10YR 6/4) silt coatings on prism faces; thin, patchy, yellowish-brown (10YR 5/4) clay films; common, fine, very dark brown (10YR 2/2) stains and concretions; 12 percent glacial pebbles; strongly acid; gradual, wavy boundary.

IIB32—58 to 90 inches, yellowish-brown (10YR 5/4) clay loam; common, medium, distinct, grayish-brown (10YR 5/2) mottles; weak, thick, platy structure in upper part and massive in lower part; firm; few gray (10YR 5/1) clay films in tubular pores in upper part; common, fine, very dark brown (10YR 2/2) concretions; 12 percent glacial pebbles; slightly acid; clear, wavy boundary.

IIC—90 to 115 inches, yellowish-brown (10YR 5/4) loam; few, medium, distinct, yellowish-brown (10YR 5/8) mottles; massive; firm; 15 percent glacial pebbles; mildly alkaline, calcareous.

The solum ranges from 48 to 120 inches in thickness but is typically 80 to 100 inches thick. The loess cap is 18 to 40 inches thick. The depth to the fragipan ranges from 18 to 38 inches in uneroded areas. The fragipan is typically light clay loam but includes light silty clay loam or loam.

Reaction is very strongly acid or strongly acid in the B horizon above a depth of 40 inches and through the fragipan in places. The B3 horizon and the fragipan can range from strongly acid to slightly acid.

The Ap horizon is dark grayish brown (10YR 4/2), or brown (10Y 5/3 and 4/3). The B2t horizon is silty clay loam, clay loam, heavy silt loam, or heavy loam. The B2t horizon and the fragipan are yellowish brown, dark yellowish brown, or strong brown; they have a hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The lower part of the B2 horizon has silt coatings of light yellowish brown (10YR 6/4) and grayish brown (10YR 5/2) that extend into the fragipan in many places. The B3 horizon has a hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The C horizon is clay loam, loam, or clay.

Cincinnati soils are part of the drainage sequence that includes moderately well drained Rossmoyne soils, somewhat poorly drained Avonburg soils, poorly drained Clermont soils, very poorly drained, dark-colored Blanchester soils, and dark-colored Patton, till substratum, soils. Cincinnati soils have a thicker solum than Hickory and Edenton soils. The lower part of the solum of Cincinnati soils formed in till, but in Jessup soils it formed in residuum of calcareous shale; in Nicholson, Boston, and Grayford soils it formed in residuum of limestone; and in Otwell soils it formed in outwash material. Cincinnati soils have a fragipan which the Russell soils lack, and they have a thicker solum than the Russell soils.

ChB—Cincinnati silt loam, 2 to 6 percent slopes. This gently sloping soil is on convex ridgetops and on short side slopes above steeper soils. Areas cover 5 to 25 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are nearly level or gently sloping, moderately well drained Rossmoyne soils. In some places Grayford soils are included. These soils are underlain by limestone, lack a fragipan, and have limestone residuum in the lower part of their subsoil.

The surface layer erodes easily, and this is the main limitation for farming. During periods of high rainfall, a perched water table develops because of the moderately slow permeability in the fragipan. Small areas of this soil on ridgetops are commonly used for tobacco because they are well drained and have good tilth. The moderately slow permeability of the fragipan is a limitation for some nonfarm uses. Capability unit IIe–1; woodland suitability group 2o1.

ChC2—Cincinnati silt loam, 6 to 12 percent slopes, moderately eroded. This sloping soil is in narrow strips along streams and above steeper soils. In some places it is on hillsides and ridgetops. Areas cover 3 to 50 acres. This soil has a profile similar to the one described as representative of the series, but erosion has removed part of the original surface layer, the fragipan is nearer the surface, and the available water capacity is lower. Plowing has mixed yellowish-brown subsoil material into the surface layer. Because the subsoil material has a high content of clay, tilth is poorer.

Included with this soil in mapping are a few wooded areas that are only slightly eroded and gently sloping and sloping Rossmoyne soils that are moderately well drained. Also included in some places are sloping and moderately steep Boston-Bratton complexes that are underlain by limestone and have limestone residuum in the lower part of their subsoil.

The hazard of erosion is severe if this soil is used for crops. Permeability is moderately slow in the fragipan,

and this is a major limitation for some nonfarm uses. Capability unit IIIe–1; woodland suitability group 2o1.

ChD2—Cincinnati silt loam, 12 to 18 percent slopes, moderately eroded. This moderately steep soil is in narrow areas along streams and waterways and on side slopes above steeper soils. Areas cover 2 to 30 acres. This soil has a profile similar to the one described as representative of the series, but erosion has removed part of the original surface layer, the fragipan is nearer the surface, and the available moisture capacity is lower.

Included with this soil in mapping are wooded areas that are only slightly eroded and moderately steep and steeper Hickory soils that lack a fragipan and have carbonates at a depth of less than 36 inches. Also included in some places are Boston-Bratton complexes that lack a fragipan, are underlain by limestone, and have limestone residuum in the lower part of the subsoil. Limestone crops out in most areas of the Boston-Bratton complexes.

The hazard of erosion is very severe if this soil is used for crops. Slope is a limitation for most nonfarm uses. Capability unit IVe–1; woodland suitability group 2r1.

Clermont Series

The Clermont series consists of poorly drained, nearly level soils that formed in loess and the underlying Illinoian glacial till. These soils are on loess mantled glacial till plains. The native vegetation was hardwood forest in which swamp oak, elm, ash, sweetgum, and soft maple were dominant.

In a representative profile in a cultivated area, the surface layer is grayish-brown silt loam 7 inches thick. The subsurface layer, to a depth of 13 inches, is light brownish-gray and light-gray silt loam that has yellowish-brown mottles and, to a depth of 25 inches, is gray silty clay loam that has strong-brown mottles. The subsoil extends to a depth of 94 inches. The upper 18 inches is gray silty clay loam that has strong-brown and brown mottles. The next 7 inches is dark-gray silty clay that has brown mottles. The next 12 inches is dark-brown clay that has dark-gray mottles. The next 16 inches is yellowish-brown and dark yellowish-brown clay that has gray mottles. The lower 16 inches is greenish-gray clay loam that has strong-brown mottles. The substratum, to a depth of 100 inches, is yellowish-brown clay loam that has dark-gray mottles and, to a depth of 116 inches, is yellowish-brown loam.

The available water capacity is high in Clermont soils. Permeability is very slow, and surface runoff is slow. The root zone is moderately deep and is commonly strongly acid to very strongly acid. These soils are ponded periodically. They have a high water table in winter and spring, and they dry out slowly after rain. They have a low to medium content of organic matter in the plow layer.

Clermont soils are used mainly for farm crops. The main crops are corn, soybeans, wheat, and grass-legume mixtures for hay and meadow. Some of the acreage is in pasture and woodland, and some is idle.

Representative profile of Clermont silt loam, in a cultivated field 6 miles west of Hillsboro, ¼ mile west of the intersection of U.S. Highway 50 and Kessler Road, and 200 feet south of U.S. Highway 50, in Union Township:

Ap—0 to 7 inches, grayish-brown (10YR 5/2) silt loam; few, medium, distinct, light yellowish-brown (10YR 6/4) mottles; weak, fine and medium, subangular blocky structure; friable; many medium roots; common tubular and vesicular pores; slightly acid; abrupt, smooth boundary.

A2—7 to 13 inches, light brownish-gray (10YR 6/2) and light-gray (10YR 6/1) silt loam; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, very thick, platy structure parting to weak, medium, subangular blocky; friable; common fine roots; common tubular and vesicular pores; strongly acid; clear, wavy boundary.

A&B—13 to 17 inches, gray (10YR 6/1) silty clay loam; many, medium, distinct, strong-brown (7.5YR 5/6) mottles; weak, medium, prismatic structure parting to weak, medium and coarse, subangular blocky; friable; common fine roots; common tubular pores; thin grayish-brown (2.5Y 5/2) clay films and gray (5Y 5/1) silt coatings on prism faces; fine specks of gray (10YR 6/1) silt sprinkled irregularly through matrix; tongues 2 to 12 millimeters thick of light brownish gray (10YR 6/2) and gray (10YR 6/1); material from the A2 horizon is on ped faces and within peds; very strongly acid; clear, wavy boundary.

B&A—17 to 25 inches, gray (10YR 6/1) silty clay loam; many, medium, distinct, strong-brown (7.5YR 5/6) mottles; weak, medium, prismatic structure parting to moderate, medium and coarse, subangular blocky; firm; few fine roots; common tubular pores; thin, very patchy, dark-gray (10YR 4/1) and gray (10YR 5/1) clay films on vertical and horizontal, irregular, rounded ped faces; gray (10YR 6/1) and light brownish-gray (10YR 6/2) tongues of material from the A2 horizon about 20 millimeters wide and 6 to 12 inches apart; silty gray (10YR 6/1) coatings on ped faces within prisms and as specks 1 to 2 millimeters in size make up 25 to 40 percent of matrix; very strongly acid; clear, wavy boundary.

B21tg—25 to 37 inches, gray (10YR 6/1) silty clay loam; many, medium, distinct, strong-brown (7.5YR 5/6) mottles; weak, very coarse, prismatic structure parting to weak, coarse, subangular blocky; firm; few fine roots; common tubular pores; gray (10YR 6/1) and light brownish-gray (10YR 6/2) silty tongues 2 to 10 millimeters thick and irregular specks of material from the A2 horizon make up about 10 percent of matrix; thin, patchy, gray (10YR 5/1) clay films on vertical and horizontal, somewhat irregular, rounded ped faces; many krotovinas 3 to 12 centimeters across, 10 to 18 inches apart, and filled with mixed gray silt loam and silty clay loam; very strongly acid; abrupt, wavy boundary.

IIB22tg—37 to 43 inches, gray (10YR 5/1) silty clay loam; many, medium, distinct, brown (7.5YR 4/4) mottles; weak, medium, prismatic structure parting to moderate, medium and fine, angular and subangular blocky; firm; few tubular pores; medium, continuous, gray (N 5/0) clay films on vertical and horizontal, somewhat irregular, rounded ped faces; gray (10YR 6/1) silty patches as much as 4 millimeters thick; few, medium, distinct, black (10YR 2/1) stains; gray (10YR 6/1) krotovinas make up 5 percent of matrix; 2 percent pebbles; very strongly acid; gradual, wavy boundary.

IIB23tg—43 to 50 inches, dark-gray (10YR 4/1) silty clay; many, medium, distinct, brown (7.5YR 4/4) mottles; weak, coarse, subangular blocky structure parting to weak, fine, subangular blocky; firm; few tubular pores; medium, continuous, dark-gray (N 4/0) clay films on vertical and horizontal, somewhat irregular, rounded ped faces; few, medium, distinct, black (10YR 2/1) stains; 5 percent gray (10YR 6/1) krotovinas; 2 percent pebbles; very strongly acid; clear, wavy boundary.

IIB24t—50 to 62 inches; dark-brown (7.5YR 3/2) clay; common, coarse, distinct, dark-gray (N 4/0) mottles; weak, coarse, subangular blocky structure parting to weak, fine, subangular blocky; firm; few tubular pores; thin, very patchy, dark-gray (10YR 4/1)

clay films on vertical, irregular, rounded ped faces; common, medium, distinct, black (10YR 2/1) stains; 5 percent gray (10YR 6/1) krotovinas; 4 percent pebbles; very strongly acid; clear, wavy boundary.

IIB31—62 to 78 inches, yellowish-brown (10YR 5/6) and dark yellowish-brown (10YR 4/4) clay; common, medium, subangular blocky structure; firm; many, coarse, prominent, black (10YR 2/1) stains; 4 percent pebbles; medium acid; clear, irregular boundary.

IIB32—78 to 94 inches, greenish-gray (5GY 6/1) clay loam; common, medium, prominent, strong-brown (7.5YR 5/6) mottles; moderate, medium, subangular blocky structure; firm; 4 percent pebbles; neutral; clear, wavy boundary.

IIC1—94 to 100 inches, yellowish-brown (10YR 5/6) clay loam; common, medium, prominent, dark-gray (N 4/0) mottles; massive; very firm; 10 percent pebbles; neutral; clear, wavy boundary.

IIC2—100 to 116 inches, yellowish-brown (10YR 5/4) loam; massive; very firm; 15 percent pebbles; mildly alkaline, calcareous.

The thickness of the solum and the depth to calcareous glacial till range from 80 to 120 inches or more but are typically 80 to 100 inches. The loess cap is 20 to 40 inches thick. The reaction is very strongly acid or strongly acid from below the Ap horizon through the B2tg horizon. It is medium acid in the upper part of the B3 horizon and neutral in the lower part of the B3 horizon.

The Ap horizon is dark grayish-brown (10YR 4/2) to gray (10YR 5/1). The A2, A&B, and B&A horizons are gray to light brownish-gray and have a hue of 10YR and 2.5Y, value of 4 to 6, and chroma of 1 or 2. They have mottles in a hue of 10YR, 7.5YR, and 5YR, value of 4 to 6, and chroma of 4 to 6.

The B2t horizon has a hue of 10YR or 7.5YR, value of 3 to 6, and chroma of 1 or 2. It has mottles in a neutral hue and in a hue of 7.5YR, value of 4 or 5, and chroma of 0 to 6. In some places the colors of the matrix and the mottles are reversed.

Clermont soils are part of the drainage sequence that includes well drained Hickory and Cincinnati soils, moderately well drained Rossmoyne soils, somewhat poorly drained Avonburg soils, and poorly drained, dark-colored Blanchester soils. Clermont soils are underlain by glacial till, but Peoga soils are underlain by lacustrine material, and Dubois soils are underlain by outwash material.

Cm—Clermont silt loam. This nearly level soil is on broad areas on the Illinoian till plain. It is commonly called "crawfish land." Areas range from 3 to more than 200 acres.

Included with this soil in mapping are somewhat poorly drained Avonburg soils on low rises. Poorly drained Blanchester soils that have a dark-colored surface layer are commonly included at the head of small drainageways. Some areas are underlain by limestone bedrock at a depth of 7 to 15 feet.

Wetness is the main limitation to use of this soil. The soil is often ponded during periods of heavy rainfall. Surface drainage is the most common method of draining the soil. Because natural drainage is poor, tobacco does not grow well on this soil. The very slow permeability in the subsoil is a severe limitation for many nonfarm uses. Capability unit IIIw–4; woodland suitability group 2w1.

Colyer Series

The Colyer series consists of well-drained, moderately steep to very steep soils that formed in thin loess and in shale residual material over shale bedrock. The Colyer soils are on dissected uplands. The native vegetation was hardwood forest in which oak, maple, hickory, and beech were dominant.

In a respresentative profile in a wooded area, the surface layer is dark-gray silt loam 2 inches thick. The subsurface layer is yellowish-brown silt loam 3 inches thick. The subsoil extends to a depth of 15 inches. The upper 4 inches is yellowish-brown silty clay loam that has light yellowish-brown mottles. The lower 6 inches is brown shaly silty clay loam. The substratum is brown very shaly silty clay loam 4 inches thick. Brown and reddish-brown shale bedrock is below a depth of 19 inches.

The available water capacity is low in Colyer soils. Permeability is moderately slow, and surface runoff is rapid. The root zone is shallow and is commonly strongly acid to extremely acid.

Colyer soils are mainly in forest. A small acreage is used for pasture and crops, but cleared areas are often left idle and eventually revert to forest.

Representative profile of Colyer silt loam, in an area of Colyer-Trappist complex, 18 to 35 percent slopes, in a wooded area 3¾ miles southeast of Rainsboro, 1 mile southeast of the intersection of Brier Hill Road and Barrett Mill Road, ½ mile northwest of the intersection of McNary Road and Barrett Mill Road, and 330 yards west of Barrett Mill Road, in Paint Township:

O1—2 inches to 1 inch, loose undecomposed leaf and twig litter from deciduous trees.

O2—1 inch to 0, very dark grayish-brown (10YR 3/2), partly decomposed leaf and twig litter.

A1—0 to 2 inches, dark-gray (10YR 4/1) silt loam; weak, fine, granular structure; very friable; many roots; 5 percent shale fragments; strongly acid; abrupt, smooth boundary.

A2—2 to 5 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, subangular blocky structure; friable; many roots; 5 percent shale fragments; very strongly acid; clear, smooth boundary.

IIB1—5 to 9 inches, yellowish-brown (10YR 5/4) silty clay loam; common, fine, faint, yellowish-brown (10YR 5/6) and light yellowish-brown (10YR 6/4) mottles; weak to moderate, fine and medium, subangular blocky structure; friable; common roots; 15 percent shale fragments; very strongly acid; clear, smooth boundary.

IIB2—9 to 15 inches, brown (7.5YR 5/4) shaly silty clay loam; moderate, fine and medium, subangular blocky structure; friable; common roots; 35 percent shale fragments; strong-brown (7.5YR 5/8), light yellowish-brown (10YR 6/4), and light brownish-gray (2.5Y 6/2) coatings on surfaces of shale fragments; very strongly acid; clear, smooth boundary.

IIC—15 to 19 inches, brown (7.5YR 5/4) very shaly silty clay loam; moderate, thin, platy, rock structure with pockets of weak, fine, subangular blocky structure; firm; few roots; 70 percent shale fragments; reddish-brown (5YR 4/4 and 5/4), yellowish-brown (10YR 5/4), and light brownish-gray (10YR 6/3) coatings on surfaces of shale fragments; very strongly acid; clear, smooth boundary.

IIR—19 inches, brown (7.5YR 5/4) and reddish-brown (5YR 4/4) shale bedrock; interiors of shale fragments are black (10YR 2/1 and 5YR 2/1); few roots; extremely acid.

The solum ranges from 7 to 18 inches in thickness but is commonly 10 to 18 inches thick. The loess mantle is 0 to 12 inches thick. Reaction in the entire profile ranges from strongly acid to extremely acid.

The A1 horizon is very dark grayish brown (10YR 3/2), dark grayish brown (10YR 4/2), or grayish brown (10YR 5/2). The A2 horizon is commonly yellowish brown (10YR 5/4) or light yellowish brown (10YR 6/4), but in some places it is light brown (7.5YR 6/4) or brown (7.5YR 5/4). The content of shale fragments in the A horizon ranges from 5 to 20 percent

The B horizon is commonly yellowish brown (10YR 5/4 and 5/6) and brown (7.5YR 5/4), but in some places it is reddish brown (5YR 4/4). The B horizon includes silt loam and silty clay loam and is shaly in places. The content of shale fragments in the B horizon ranges from 20 to 50 percent.

The color of the C horizon is similar to that of the B horizon. The content of shale fragments in the C horizon ranges from 50 to 80 percent.

The Colyer soils in Highland County contain less clay in the earth fraction of the profile than is defined in the range for the Colyer series. This difference, however, does not alter their usefulness or behavior.

Colyer soils are part of the drainage sequence that includes well-drained Trappist and Muse soils. Colyer soils have a thinner, coarser textured solum and are shallower to bedrock than Trappist and Muse soils. Colyer soils formed over acid shale bedrock, but Gasconade and Opequon soils formed over limestone bedrock.

CoD2—Colyer–Trappist complex, 12 to 18 percent slopes, moderately eroded. These moderately steep soils are on ridgetops, toe slopes, and hillsides on the unglaciated Allegheny Plateau. Areas of this complex cover 2 to 12 acres. They vary from oval or rounded to irregularly shaped; they are narrow to medium in width, and most are elongated. Many of the areas are oval or fan-shaped at the head of drainageways and run laterally along the drainageways for several hundred feet. This complex commonly joins steeper Coyler-Trappist complexes downstream. Slopes are mainly convex and range from 150 to 400 feet in length. About 35 percent of the complex is Colyer soils, and 35 percent is Trappist soils.

The soils of this complex have profiles similar to those described as representative of the Colyer and Trappist series, but their surface layer is a mixture of the original surface layer and subsoil material, is browner, and contains more shale fragments. The content of shale fragments in the surface layer ranges from 10 to 50 percent or more and varies considerably within short horizontal distances.

Included with these soils in mapping are many severely eroded spots at the crest of the slopes. These spots have a surface layer of shaly silty clay loam and support little or no vegetation. Also included are some shallow to deep gullies, scattered bedrock outcrops, and extremely acid soils. Seep areas and springs at the base of many slopes are also included.

This complex has been cleared for crops and pasture, but most areas are now in permanent pasture or are idle and are reverting to woodland. Slope erosion, the extremely acid areas, and the shallowness to shale bedrock are severe limitations for cultivated crops and for most nonfarm uses. This complex is better suited to permanent pasture and woodland. Capability unit VIs–1; woodland suitability group 4d2.

CoF—Colyer-Trappist complex, 18 to 35 percent slopes. This steep complex is on the hillsides. Areas range from 3 to 50 acres in size and from oval or rounded to irregular in shape, but most are elongated and are 100 to 300 feet wide. Many of the areas encircle hills. Some areas run laterally along streams or drainageways for several hundred feet. In many places this complex joins the steep to very steep Colyer and Trappist soils further downstream. The slopes of this complex are mainly convex, although there are many concave areas and small benchlike areas. The slopes range from 150 to 600 feet in length. About 50 percent of the acreage is Colyer soil, and 35 percent is Trappist soil.

The Colyer soil in this complex has the profile described as representative of the Colyer series. The content of shale fragments in the surface layer of these soils ranges from 0 to 35 percent and varies considerably within short horizontal distances.

Included with these soils in mapping are small areas that are moderately or severely eroded and that have small gullies, a finer textured surface layer, and rock outcrops. Larger areas of Tuscarawas channery silt loam are included on the upper part of slopes next to steeper Berks-Muskingum-Neotoma channery silt loams. Many seep areas and springs are included on the steep slopes.

Most of the acreage of this complex is woodland. The shallowness to bedrock and steep slopes are severe limitations for farming and for most nonfarm uses. Capability unit VIIs–1; woodland suitability group 4d2.

CoG—Colyer-Trappist complex, 35 to 50 percent slopes. This very steep complex is on hillsides on the unglaciated Allegheny Plateau. Areas generally range from 6 to 65 acres, but one area of this complex is about 1,000 acres, and another is more than 400 acres. The areas range from oval or rounded to irregular in shape, but most are elongated. They range from 100 to 500 feet in width. Many areas encircle hills. Some run laterally along the streams or drainageways. The slopes are mainly convex, although there are many concave areas and small benchlike areas. They range from 150 to 600 feet in length About 65 percent of the acreage is Colyer soils, and 25 percent is Trappist soils.

Included with these soils in mapping are small areas that are moderately or severely eroded and that have small gullies, a finer textured surface layer, and rock outcrops.

Most of the acreage of this complex is woodland. The shallowness to bedrock and the slope are severe limitations to farm and nonfarm uses. The large, remote, inaccessible areas of the complex are suited to wildlife habitat and recreation uses. Capability unit VIIs–1; woodland suitability group 5d1.

Crosby Series

The Crosby series consists of somewhat poorly drained, nearly level and gently sloping soils that formed in thin loess and the underlying glacial till of Wisconson age. The Crosby soils are on the glacial till plain. The native vegetation was hardwood forest in which maple, beech, oak, elm, and ash were dominant.

In a representative profile in a cultivated area, the surface layer is dark grayish-brown silt loam 9 inches thick. The subsoil extends to a depth of 31 inches. The upper 3 inches is yellowish-brown silty clay loam that has grayish-brown mottles. The next 14 inches is dark yellowish-brown clay that has yellowish-brown, gray, and grayish-brown mottles. The lower 5 inches is yellowish-brown clay loam that has grayish-brown and yellowish-brown mottles. The substratum is yellowish-brown loam that has gray and yellowish-brown mottles to a depth of 60 inches.

The available water capacity is medium in Crosby soils. Permeability is slow, and surface runoff is slow to very slow. These soils have a high water table in winter and spring, and they dry out slowly after rain. The root zone is moderately deep and is neutral to medium acid.

Crosby soils are used mainly for corn, soybeans, wheat, and grass-legume mixtures for hay and pasture. A small acreage is in permanent pasture or woodland.

Representative profile of Crosby silt loam, 0 to 2 percent slopes, in a cultivated field 2½ miles west of Greenfield on State Route 28, 1 mile north on Collier Road, 1 mile northwest on Bennett Road from its intersection with Collier Road, 110 yards south of the intersection of Pommert Road and Bennett Road, and 100 yards west of Bennett Road, in Madison Township:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, granular structure; friable; many roots; few pebbles; neutral; abrupt, smooth boundary.

IIBlt—9 to 12 inches, yellowish-brown (10YR 5/4) silty clay loam; common, fine, distinct, gray (10YR 5/1) and grayish-brown (10YR 5/2) mottles; moderate, medium, subangular blocky structure; firm; common roots; thin, very patchy, very dark grayish-brown (10YR 3/2) clay films on vertical and horizontal ped faces; 8 percent pebbles; slightly acid; clear, smooth boundary.

IIB21t—12 to 19 inches, dark yellowish-brown (10YR 4/4) clay; common, fine and medium, distinct, gray (10YR 5/1) and grayish-brown (10YR 5/2) mottles; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky; firm; common roots; thin, patchy, dark grayish-brown (10YR 4/2) and very dark grayish-brown (10YR 3/2) clay films on vertical and horizontal ped faces; 8 percent pebbles; medium acid; clear, wavy boundary.

IIB22t—19 to 26 inches, dark yellowish-brown (10YR 4/4) clay; common, medium, distinct, yellowish-brown (10YR 5/6) mottles and common, fine, distinct, grayish-brown (10YR 5/2) mottles; weak, medium, prismatic structure parting to moderate, medium, subangular blocky; firm; few roots; medium, patchy, dark grayish-brown (10YR 4/2) clay films on vertical and horizontal ped faces; 15 percent pebbles; slightly acid; clear, wavy boundary.

IIB3t—26 to 31 inches, yellowish-brown (10YR 5/4) clay loam; common, fine, distinct, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/6) mottles; weak, medium and coarse, subangular blocky structure; firm to friable; few roots; thin, patchy, dark grayish-brown (10YR 4/2) clay films on vertical ped faces; 15 percent pebbles; neutral to mildly alkaline; clear, wavy boundary.

IIC—31 to 60 inches, yellowish-brown (10YR 5/4) loam; common, medium, distinct, gray (10YR 6/1) mottles and many, fine, distinct, yellowish-brown (10YR 5/8) mottles; massive; firm and compact; 18 percent pebbles; mildly alkaline, calcareous.

The solum is 20 to 40 inches thick and the loess cap is 0 to 18 inches thick. Reaction in the solum ranges from very strongly acid to mildly alkaline but is mainly medium acid to neutral.

The Ap horizon is mainly dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2). Immediately beneath the Ap horizon and throughout all horizons below, there are mottles of grayish brown (10YR 5/2), light brownish gray (10YR 6/2), or light gray (10YR 6/1) and mottles with a hue of 2.5Y and comparable value and chroma. In undisturbed areas there is a very dark gray (10YR 3/1) or very dark grayish-brown (10YR 3/2) Ap horizon 1 to 4 inches thick. In some profiles there is an A2 horizon 2 to 4 inches thick below the Ap horizon.

The B horizon is commonly dark yellowish brown (10YR 4/4) or yellowish brown (10YR 5/4 and 5/6), but in some places it has a hue of 2.5Y with comparable value and chroma. The B2t horizon has very dark grayish-brown (10YR 3/2) or dark grayish-brown (10YR 4/2), thin and medium, patchy and continuous clay films.

The C horizon is mainly yellowish brown (10YR 5/4) or brown (10YR 5/3).

Crosby soils are part of the drainage sequence that includes well drained Hennepin and Miamian soils, moderately well drained Colina soils, and very poorly drained, dark-colored Brookston soils. Crosby soils are shallower to calcareous glacial till, have a higher clay content in the B2t horizon, and have a thinner loess cap than Fincastle soils. They are underlain by glacial till, and McGary soils are underlain by lacustrine material. Crosby soils have a finer textured solum and lack the calcareous outwash material that underlie Fitchville and Sleeth soils. They are shallower to calcareous till than Atlas soils.

CrA—Crosby silt loam, 0 to 2 percent slopes. This nearly level to slightly depressional soil is on narrow to broad transitional areas between Miamian or Celina and Brookston soils. It is also in fan-shaped areas at the head of minor waterways and is along small, crossable waterways. The size and shape of areas of this soil vary. Areas range from 2 to 50 acres, but most are 2 to 10 acres.

This soil has the profile described as representative of the series. It is subject to seepage from adjacent soils, and depressions are subject to ponding. In some places the surface layer is thicker because it has been covered by material washed in from surrounding soils.

Included with this soil in mapping are some small, oval or rounded, convex humps or knolls of Celina soils. Some areas of wetter, dark-colored Brookston soils along the small drainageways and in depressions are also included.

Wetness, a seasonal high water table, slow permeability, and crusting are moderate limitations for farming and for most nonfarm uses. Capability unit IIw–2; woodland suitability group 3w1.

CsA—Crosby-Fincastle silt loams, 0 to 2 percent slopes. This nearly level to slightly depressional complex is on narrow to broad transitional areas between Miamian-Russell or Celina-Xenia complexes and Brookston soils. It is also in fan-shaped areas at the head of minor waterways and is along small, crossable waterways. Areas vary in shape and generally range from 2 to 40 acres in size. About 50 percent of the acreage is Crosby soil, and 4 percent in Fincastle soil.

The Fincastle soil in this complex has the profile described as representative of the Fincastle series. The complex is subject to seepage from adjacent soils, and the depressions are subject to ponding. In many places the surface layer is thicker, because it has been covered by silty material washed in from surrounding soils.

Included with this soil in mapping are a few small areas of poorly drained, dark-colored Brookston soils in depressions and along waterways.

Excess surface water, a seasonal high water table, slow permeability, and crusting are moderate limitations for farming and for most nonfarm uses. Capability unit IIw–2; woodland suitability group 3w1.

CsB—Crosby-Fincastle silt loams, 2 to 6 percent slopes. This gently sloping complex is on the broad transitional areas between Miamian-Russell or Celina-Xenia complexes and Brookston soils. It is also on narrow, short slopes along minor drainageways. Most areas range from 3 to 20 acres. The slopes are slightly concave. About 5 percent of the acreage is Crosby soil, and 35 percent is Fincastle soil.

Included with this complex in mapping are some small, oval or rounded, convex humps or knolls of Celina soils. Some areas of wetter, dark-colored Brookston soils along the small drainageways and in depressions are also included.

The hazard of erosion is moderate. The soils tend to crust, and they require drainage if they are farmed. The slow permeability, a seasonal high water table, and ponding of short duration are limitations for most nonfarm

uses. Capability unit IIw–2; woodland suitability group 3w1.

CuA—Crosby-Urban land complex, nearly level. This complex consists of nearly level areas where grading and digging have destroyed or covered much of the original soil. Most of these areas are used for urban and industrial development in and near Greenfield. About 40 to 50 percent of the acreage is disturbed soils. There are undisturbed Crosby soils in undeveloped lots, in the back part of developed lots, and in the unused part of mobile home parks.

Fill areas have about 1 to 3 feet of fill material overlying undisturbed Crosby soils. The fill material consists of clay loam and clay subsoil material and loam substratum material from borrow areas of Celina and other nearby soils.

Included with this complex in mapping are Brookston soils and small areas of Celina soils.

The surface layer of the disturbed areas commonly has low content of organic matter and is in poor physical condition. The compact calcareous till and the amount of clay in the surface layer cause seed germination to be generally poor. Wetness is a limitation for most nonfarm uses. Capability unit and woodland suitability group not assigned.

Dana Series

The Dana series consists of moderately well drained, nearly level to gently sloping soils that formed in loess and the underlying glacial till of Wisconsin age. The Dana soils are on glacial till plains. The native vegetation was prairie grasses intermixed with hardwood forest in which beech, hard maple, and oak were dominant.

In a representative profile in a cultivated area, the surface layer is very dark grayish-brown silt loam 14 inches thick. The subsoil extends to a depth of 48 inches. The upper 6 inches is dark yellowish-brown silty clay loam. The next 12 inches is yellowish-brown silty clay loam that has grayish-brown and yellowish-brown mottles. The lower 8 inches is yellowish-brown clay loam that has light brownish-gray and dark-brown mottles. The substratum is yellowish-brown loam that has gray and light brownish-gray mottles to a depth of 60 inches.

The available water capacity is high in Dana soils. Permeability is moderate, and surface runoff is slow to medium. The root zone is deep and is slightly acid to strongly acid.

Dana soils are used mainly for corn, soybeans, wheat, and grass-legume mixtures for hay and pasture. A small acreage is in permanent pasture or woodland.

Representative profile of Dana silt loam, 2 to 6 percent slopes, in a cultivated field 1 mile west of Careytown, 230 yards south of New Vienna East Road, and 150 feet north of a small drainageway, in Penn Township:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine and medium, granular structure; very friable; many roots; 2 percent pebbles; slightly acid; abrupt, smooth boundary.

A12—9 to 14 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium and coarse, granular structure; friable; common roots; 2 percent pebbles; medium acid; clear, wavy boundary.

B1—14 to 20 inches, yellowish-brown (10YR 5/4) heavy silt loam; weak to moderate, fine and medium, subangular blocky structure; friable; few roots; 2 percent pebbles; very dark grayish-brown (10YR 3/2) and dark grayish-brown (10YR 4/2) organic stains in old root channels, in pores, and on some ped faces; 2 percent pebbles; medium acid; clear, wavy boundary.

B21t—20 to 28 inches, dark yellowish-brown (10YR 4/4) silty clay loam; moderate, medium, subangular blocky structure; firm; few roots; thin, patchy, dark-brown (10YR 4/3) clay films on vertical and horizontal ped faces; 5 percent pebbles; strongly acid; gradual, wavy boundary.

IIB22t—28 to 40 inches, yellowish-brown (10YR 5/4) silty clay loam; common, medium, distinct, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/8) mottles; moderate to strong, medium, subangular blocky structure; firm; thin, patchy, dark-brown (7.5YR 4/4) clay films on horizontal ped faces and medium, continuous, dark-brown (7.5YR 4/4) clay films on vertical ped faces; common, medium, distinct, very dark grayish-brown (10YR 3/2) stains and concretions; 10 percent pebbles; strongly acid; gradual, wavy boundary.

IIB3t—40 to 48 inches, yellowish-brown (10YR 5/4) clay loam; common, medium, distinct, light brownish-gray (10YR 6/2) mottles and few, medium, faint, yellowish-brown (10YR 5/6) and dark-brown (10YR 4/3) mottles; weak, medium and coarse, subangular blocky structure; firm; thin and medium, patchy, dark-brown (7.5YR 4/4) clay films on vetical ped faces; few, medium, distinct, very dark grayish-brown (10YR 3/2) stains and concretions; 10 percent pebbles; medium acid at a depth of 40 inches and neutral at a depth of 46 inches; clear, irregular boundary.

IIC—48 to 60 inches, yellowish-brown (10YR 5/4) loam; common, medium, distinct, gray (10YR 5/1) and light brownish-gray (10YR 6/2) mottles; weak, coarse, subangular blocky structure; friable; thin, patchy, dark-brown (7.5YR 4/4 and 10YR 4/3) clay films on ped faces of vertical cracks; 15 percent pebbles; mildly alkaline, calcareous.

The solum ranges from 36 to 66 inches in thickness but is mainly 40 to 66 inches thick. The loess cap is 22 to 40 inches thick.

The Ap and A1 horizons are very dark grayish brown (10YR 3/2), very dark brown (10YR 2/2), or black (10YR 2/1) and are 10 to 18 inches thick.

The B horizon has subangular blocky or prismatic structure. It is mainly yellowish brown (10YR 5/4) or dark yellowish brown (10YR 4/4). Mottles are within 30 inches of the surface and are yellowish brown (10YR 5/6 and 5/8), grayish brown (10YR 5/2), light brownish gray (10YR 6/2), and gray (10YR 6/1). The B2t and B3 horizons are silty clay loam and clay loam.

The C horizon is yellowish brown (10YR 5/4 and 5/6) or brown (10YR 4/3 and 5/3) and has gray (10YR 5/1 and 6/1) and light brownish-gray (10YR 6/2) mottles.

Dana soils have a darker colored A horizon than Xenia soils. They have better natural drainage than Brookston and Patton soils. Dana soils are underlain by glacial till, but Wea soils are underlain by sand and gravel, and Ross soils are underlain by alluvial material.

DaA—Dana silt loam, 0 to 2 percent slopes. This soil is in areas of 3 to 10 acres. The areas of this soil vary in shape, ranging from fan shaped, oval, or rounded to somewhat irregular. The fan-shaped to rounded areas are at the head of small drainageways.

This soil has a profile similar to the one described as representative of the series, but its surface layer is thicker. The concave or slightly depressional areas are subject to seepage and periodic inwash from the surrounding, steeper Miamian and Celina soils. In these areas 6 to 12 inches of light-colored silty inwash material overlies the dark-colored surface layer.

Included with this soil in mapping are very poorly drained Brookston soils and light-colored Crosby and Celina soils.

This soil has few limitations for farming. Seasonal wetness is a limitation for many nonfarm uses. Capability unit I–1; woodland suitability group 2o1.

DaB—Dana silt loam, 2 to 6 percent slopes. This gently sloping soil is on Wisconsin glaciated areas. Areas of this soil cover 3 to 10 acres. They vary in shape, ranging from fan shaped, oval or rounded to somewhat irregular. The fan-shaped to rounded areas are at the head of small drainageways. The areas at the head of and along the drainageways are transitional between the Miamian and Celina soils upslope and the Crosby and dark-colored Brookston soils downslope. The slopes are slightly concave, are short, and are mainly 2 to 4 percent. This soil has the profile described as representative of the series.

Included with this soil in mapping are dark-colored, very poorly drained Brookston soils in narrow strips along the draingeways and light-colored Crosby and Celina soils on humps and in transitional areas. Also included are some areas of well-drained, dark-colored soils.

The hazard of erosion is moderate if this soil is used for crops. A few wet spots require drainage. Moderate permeability and seasonal wetness are the main limitations for many nonfarm uses. Capability unit IIe–1; woodland suitability group 2o1.

Dubois Series

The Dubois series consists of somewhat poorly drained, nearly level to gently sloping soils that formed in loess and the underlying stratified, lacustrine material. The Dubois soils are on lake plains, high stream terraces, and kames and moraines. The native vegetation was hardwood forest in which oak, elm, gum, and maple were dominant.

In a representative profile in a cultivated area, the surface layer is dark grayish-brown silt loam 8 inches thick. The subsurface layer is pale-brown and yellowish-brown silt loam that has light brownish-gray mottles and extends to a depth of 15 inches. The subsoil extends to a depth of 103 inches. The upper 8 inches is brown silty clay loam that has light brownish-gray and yellowish-brown mottles. Next, in sequence downward, is 8 inches of brown silty clay loam that has light brownish-gray and yellowish-brown mottles; 6 inches of gray, firm and brittle, silty clay loam that has strong-brown mottles; 12 inches of yellowish-brown, firm and brittle, silty clay loam that has gray mottles; 10 inches of yellowish-brown, firm and brittle, clay loam that has gray mottles; 28 inches of dark yellowish-brown clay loam that has gray and yellowish-brown mottles; and 16 inches of strong-brown gravelly clay loam that has gray mottles. The substratum extends to a depth of 131 inches. The upper 22 inches is yellowish-brown gravelly clay loam that has grayish-brown mottles, and the lower 6 inches is strong-brown gravelly loam.

The available water capacity is medium in Dubois soils. Permeability is very slow, and surface runoff is slow to medium. These soils have a high water table in winter and spring, and they dry out slowly after rain. The root zone is moderately deep and is medium acid to strongly acid.

Dubois soils are used mainly for corn, wheat, soybeans, and grass-legume mixtures for hay and pasture. A small acreage is idle.

Representative profile of Dubois silt loam, 0 to 2 percent slopes, in a cultivated field 3⅘ miles east-southeast of Hillsboro on State Route 124, ⅝ mile north-northeast of the intersection of State Route 124 and County Home Road, and ½ mile east-northeast of County Home and 800 feet south-southeast of County Home Road, in Liberty Township:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; very friable; many roots; few pebbles; neutral; abrupt, smooth boundary.

A&B—8 to 15 inches, pale-brown (10YR 6/3) and yellowish-brown (10YR 5/4) silt loam; few, fine, distinct, light brownish-gray (10YR 6/2) mottles; weak, thick, platy structure parting to weak, fine, subangular blocky; very friable; common roots; few pebbles; medium acid; abrupt, wavy boundary.

B21t—15 to 23 inches, brown (7.5YR 4/4) silty clay loam; many, medium, distinct, light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; firm; common roots; medium, patchy, gray (10YR 5/1) clay films on vertical and horizontal, somewhat irregular, rounded ped faces; few pebbles; medium acid; clear, wavy boundary.

IIB22t—23 to 31 inches, brown (7.5YR 4/4) silty clay loam; many, medium, distinct, light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/6) mottles; moderate, coarse, prismatic structure parting to weak, medium, subangular blocky; very firm; few roots; medium, patchy, gray (10YR 5/1) clay films on vertical, somewhat irregular, rounded ped faces and thin, very patchy, gray (10YR 5/1) clay films on horizontal, somewhat irregular, rounded ped faces; thin, very patchy, pale-brown (10YR 6/2) silt coatings on vertical ped faces; few pebbles; medium acid; clear, wavy boundary.

IIBx1—31 to 37 inches, gray (10YR 5/1) silty clay loam; common, medium, distinct, strong-brown (7.5YR 5/6) mottles; weak, thick, platy structure parting to weak, fine, subangular blocky; firm; few roots; thin, patchy, gray (10YR 5/1) clay films on vertical and horizontal, irregular, rounded ped faces; few pebbles; very strongly acid; abrupt, irregular boundary.

IIBx2—37 to 49 inches, yellowish-brown (10YR 5/4) silty clay loam; common, medium, distinct, gray (10YR 5/1) and yellowish-brown (10YR 5/8) mottles; weak, thick, platy structure parting to weak, fine, subangular blocky; firm; thin, very patchy, dark-gray (10YR 4/1) clay films on vertical and horizontal, irregular, rounded ped faces; few, medium, prominent, black (10YR 2/1) stains; 5 percent pebbles; very strongly acid; clear, wavy boundary.

IIBx3—49 to 59 inches, yellowish-brown (10YR 5/4) clay loam; common, medium, distinct, gray (10YR 5/1) and yellowish-brown (10YR 5/8) mottles; weak, very thin, platy structure parting to weak, medium, subangular blocky; firm: thin, very patchy, dark-gray (10YR 4/1) clay films on irregular, rounded ped faces; few, medium, prominent, black (10YR 2/1) stains; 5 percent pebbles; medium acid; gradual, wavy boundary.

IIB31—59 to 71 inches, dark yellowish-brown (10YR 4/4) clay loam; common, medium, distinct, gray (10YR 5/1) and yellowish-brown (10YR 5/8) mottles; weak, coarse and medium, subangular blocky structure; firm; few, medium, prominent, black (10YR 2/1) stains; 5 percent pebbles; neutral; clear, wavy boundary.

IIB32—71 to 87 inches, dark yellowish-brown (10YR 4/4) clay loam; common, medium and coarse, distinct, gray (10YR 5/1) mottles and common, medium and fine, faint, yellowish-brown (10YR 5/8) mottles; weak,

coarse, subangular blocky structure; firm; common, medium, prominent, black (10YR 2/1) stains; 5 percent pebbles; moderately alkaline; clear, wavy boundary.

IIB33—87 to 103 inches, strong-brown (7.5YR 5/6) gravelly clay loam; common, medium, distinct, gray (10YR 6/1) mottles; weak, coarse, subangular blocky structure; firm; 20 percent gravel; moderately alkaline; clear, wavy boundary.

IIC—103 to 125 inches, yellowish-brown (10YR 5/6) gravelly clay loam; common, coarse, distinct, grayish-brown (10YR 5/2) mottles; massive, firm; 20 percent gravel; moderately alkaline; abrupt, wavy boundary.

IIIC—125 to 131 inches, strong-brown (7.5YR 5/6) gravelly loam; massive; friable; 20 percent pebbles; brownish-yellow (10YR 6/6) weathered remnants of limestone; moderately alkaline, calcareous.

The solum is 80 to 120 inches thick. The loess cap is about 20 to 40 inches thick. The depth to stratified material ranges from about 35 to 50 inches. Reaction is very strongly acid to medium acid below the Ap horizon through the Bx horizons and ranges to moderately alkaline in the B3 and upper C horizons.

The Ap horizon is dark brown (10YR 3/3) to dark grayish brown (10YR 4/2).

The depth to the Bx horizon is 20 to 35 inches, and the horizon is 14 to 36 inches thick.

The C horizon is highly variable within short horizontal distances. In many places it has a relatively low content of gravel. In some places it has fine-textured lacustrine deposits between depths of 55 and 70 inches. In other places the C horizon contains sand and gravel at a depth of 8 to 12 feet.

Dubois soils are part of the drainage sequence that includes well drained Otwell soils and moderately well drained Haubstadt soils. Dubois soils are underlain by stratified lacustrine material, but Avonburg, Atlas, and Fincastle soils are underlain by glacial till. Unlike Fincastle, Sleeth, and Fitchville soils, Dubois soils have a fragipan. Their underlying material is more acid than that of Sleeth and Fitchville soils.

DuA—Dubois silt loam, 0 to 2 percent slopes. This nearly level to depressional soil is on Illinoian outwash terraces. Areas cover 2 to 95 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are poorly drained soils that have a grayer surface layer and lack a fragipan. In some places at the head of drainageways, dark-colored soils that lack a fragipan and are very poorly drained are also included.

Seasonal wetness is the main limitation for farming. Ponding is common during periods of heavy rainfall. Surface drainage is the most common method of removing excess water. Because natural drainage is somewhat poor, tobacco does not grow well on this soil. The very slow permeability in the fragipan and a seasonal high water table are severe limitations for many nonfarm uses. Capability unit IIIw–1; woodland suitability group 2w2.

DuB—Dubois silt loam, 2 to 6 percent slopes. This gently sloping soil is on Illinoian outwash terraces. It is commonly on broad ridges next to steeper, moderately well drained soils along the edge of the ridges. In some places this soil is on low rises sourrounded by nearly level soils. Areas of this soil cover 2 to 40 acres.

Included with this soil in mapping are nearly level, poorly drained soils that have a grayer surface layer and lack a fragipan. In some places near the head of drainageways, dark-colored soils that lack a fragipan and are very poorly drained are included. Small areas of moderately well drained Haubstadt soils are also included.

Seasonal wetness is the main limitation for farming. Excess water should be removed by surface drainage. Because natural drainage is somewhat poor, tobacco does not grow well on this soil. The very slow permeability in the fragipan and seasonal wetness are limitations for many nonfarm uses. Capability unit IIIw–2; woodland suitability group 2w2.

Edenton Series

The Edenton series consists of well-drained, sloping to very steep soils. These soils formed in loess and the underlying Illinoian glacial till over residuum weathered from limestone and shale bedrock. They are on dissected Illinoian glacial till uplands. The native vegetation was deciduous and coniferous forest of beech, maple, oak, ash, and redcedar.

In a representative profile, the surface layer is brown silt loam 4 inches thick. The subsoil extends to a depth of 32 inches. The upper 16 inches is yellowish-brown clay loam. The next 6 inches is yellowish-brown clay. The lower 6 inches is yellowish-brown silty clay. The substratum, to a depth of 38 inches, is light olive-brown and dark yellowish-brown silty clay. Below that is interbedded shale and limestone bedrock.

The available water capacity is medium in Edenton soils. Permeability is moderately slow, and surface runoff is rapid to very rapid. The root zone is moderately deep and is commonly neutral to strongly acid.

Some areas of sloping Edenton soils are used for crops, but most of the acreage is in permanent pasture or forest.

Representative profile of Edenton silt loam, 12 to 18 percent slopes, moderately eroded, 2¼ miles west-northwest of Belfast, west of State Route 73 on Peach Orchard Road to Smart Hill Lane, and 500 yards south and 75 feet east in Jackson Township:

Ap—0 to 4 inches, brown (10YR 5/3) heavy silt loam; weak, medium, subangular blocky structure; friable; 8 percent pebbles; medium acid; clear, smooth boundary.

B21t—4 to 12 inches, yellowish-brown (10YR 5/6) clay loam; moderate, medium, subangular blocky structure; firm; thin, very patchy, dark-brown (7.5YR 4/4) clay films on ped faces; few, medium, prominent, black (10YR 2/1) stains; 10 percent pebbles; strongly acid; clear, wavy boundary.

B22t—12 to 20 inches, yellowish-brown (10YR 5/6) clay loam; moderate, medium, subangular blocky structure; firm; dark yellowish-brown (10YR 4/4) clay films that are thin and patchy on vertical ped faces and very patchy on horizontal ped faces; common, medium, prominent, black (10YR 2/1) stains; 10 percent pebbles; medium acid; clear, wavy boundary.

B23t—20 to 26 inches, yellowish-brown (10YR 5/4) clay; common, medium, distinct, yellowish-brown (10YR 5/8) mottles; weak, medium and coarse, subangular blocky structure; firm; dark yellowish-brown (10YR 4/4) clay films that are thin and patchy on vertical ped faces and very patchy on horizontal ped faces; common, medium, prominent, very dark brown (10YR 2/2) stains; 10 percent pebbles; neutral; clear, wavy boundary.

IIB3—26 to 32 inches, yellowish-brown (10YR 5/4) silty clay; weak, coarse, subangular blocky structure; very firm; few, fine, prominent, very dark brown (10YR 2/2) stains; light olive-gray (5Y 6/2) vertical and horizontal pressure faces; less than 2 percent pebbles; mildly alkaline; abrupt, smooth boundary.

IIC1—32 to 38 inches, light olive-brown (2.5Y 5/6) and dark yellowish-brown (10YR 4/4) silty clay; weak, coarse, subangular blocky structure; very firm; few, fine, distinct, very dark grayish-brown (10YR 3/2) stains; light olive-gray (5Y 6/2) and light olive-brown (2.5Y 5/4) pressure faces; less than 2 percent pebbles;

mildly alkaline, calcareous; abrupt, irregular boundary.

IIC2—38 inches, interbedded calcareous shale and limestone.

The solum is 20 to 40 inches thick and the depth to shale and limestone residuum is 20 to 38 inches. The depth to carbonates ranges from 20 to 36 inches. In some places there is a loess mantle as much as 10 inches thick. Reaction ranges from medium acid to neutral in the surface layer; it is slightly acid to strongly acid in the upper part of the B horizon and neutral or mildly alkaline in the lower part. The horizons that developed in till are 5 to 20 percent glacial pebbles.

The Ap horizon ranges from dark grayish brown (10YR 4/2) to yellowish brown (10YR 5/4). In unplowed areas there is a very dark grayish-brown (10YR 3/2) or dark-brown (10YR 3/3 or 4/3) A1 horizon as much as 4 inches thick. In some places there is an A2 horizon of grayish brown (10YR 5/2) or brown (10YR 5/3) silt loam.

The upper part of the B horizon, which developed in till, has a hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam, silty clay loam, or clay. Clay films in the Bt horizon are thin or medium and patchy or very patchy. The lower part of the B horizon, which developed in residuum, has a hue of 10YR to 5Y, value of 4 to 6, and chroma of 4 to 6. The IIB horizon is silty clay or clay and has weak or moderate, subangular blocky structure.

In some places, where the residuum is at a depth of 38 inches, the entire B horizon developed in till.

The C horizon has a hue of 5Y to 10YR, value of 4 or 5, and chroma of 3 to 6. Other colors are present as mottles and streaks in some places. The C horizon is clay or silty clay, and in places it contains pebbles and fragments of chert, limestone, or shale.

The well drained Edenton soils are part of the drainage sequence that includes well drained Cincinnati soils, moderately well drained Rossmoyne soils, somewhat poorly drained Avonburg soils, and poorly drained Blanchester soils. Edenton soils differ from Cincinnati soils in having a regolith that includes limestone residuum. They formed in glacial till over limestone residuum and bedrock, but Trappist soils formed in residuum weathered from acid shale bedrock. Edenton soils are shallower to bedrock than Jessup and Loudon soils.

EbC2—Edenton silt loam, 6 to 12 percent slopes, moderately eroded. This sloping soil is commonly above steeper soils. In some places it is in narrow strips below gently sloping soils. Areas cover 2 to 20 acres.

Included with this soil in mapping are spots of Rossmoyne soils that have a fragipan and are underlain by calcareous till. Loudon soils that are underlain by calcareous shale are also included.

Erosion is the main limitation if this soil is farmed. The moderately slow permeability in the lower part of the subsoil and the shallowness to underlying bedrock are limitations for most nonfarm uses. Capability unit IIIe-3; woodland suitability group 4d1.

EbD2—Edenton silt loam, 12 to 18 percent slopes, moderately eroded. This moderately steep soil is commonly below gently sloping to sloping soils. Areas cover 2 to 25 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are spots of Hickory soils that are underlain by calcareous till within a depth of 36 inches and small areas of Loudon soils that are underlain by calcareous shale. In some places there are areas of sloping Rossmoyne and Cincinnati soils that have a fragipan and are underlain by till. Also included are severely eroded areas where most of the original surface layer has been removed and bedrock is at or near the surface.

The hazard of erosion is severe. Moderately slow permeability in the lower part of the subsoil, slope, and the shallowness to underlying bedrock are severe limitations for most nonfarm uses. Capability unit IVe–3; woodland suitability group 3r1.

EbF2—Edenton silt loam, 18 to 35 percent slopes, moderately eroded. This steep to very steep soil is on narrow hillsides and along slope breaks. It commonly lies below sloping to moderately steep soils. Areas of this soil cover 2 to 25 acres.

Included with this soil in mapping are spots of steep to very steep Hickory soils that are underlain by calcareous till within a depth of 36 inches and small areas of Loudon soils that are underlain by calcareous shale. Included in some places are areas of dark-colored Gasconade soils that are underlain by calcareous shale and limestone within a depth of 20 inches. A few wooded areas that are only slightly eroded are also included.

The hazard of erosion is severe. Moderately slow permeability in the lower part of the subsoil, slope, and shallowness to underlying bedrock are major limitations for most nonfarm uses. Capability unit VIe–2; woodland suitability group 3r1.

Eel Series

The Eel series consists of moderately well drained, nearly level soils that formed in alluvial material. These soils are on flood plains of streams and rivers. The native vegetation was hardwood forest of maple, sycamore, eastern cottonwood, and elm.

In a representative profile in a cultivated area, the surface layer is dark grayish-brown silt loam 9 inches thick. The subsoil extends to a depth of 40 inches. The upper 7 inches is brown silt loam that has yellowish-brown mottles. The next 7 inches is dark-brown silt loam that has dark grayish-brown, dark-gray, and light brownish-gray mottles. The next 6 inches is dark grayish-brown silt loam that has dark-gray and pale-brown mottles. The lower 11 inches is dark grayish-brown loam that has brown and yellowish-red mottles. The substratum is dark-gray and dark grayish-brown sandy loam that has brown and yellowish-red mottles to a depth of 63 inches and is yellowish-brown, brown, and gray, loose sand to a depth of 75 inches.

The available water capacity is high in Eel soils. Permeability is moderate, and surface runoff is slow. The root zone is deep and is slightly acid to moderately alkaline.

Eel soils are used mainly for corn, soybeans, wheat, and some tobacco. Where flooding is more frequent, Eel soils are used more for hay and pasture and woodland. Few acres of Eel soils are left idle.

Representative profile of Eel silt loam, in a cultivated field ⅝ mile south of Allensburg on Abernathy Road, 150 yards east of Abernathy Road, and 75 yards south of Dodson Creek, in Dodson Township:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, granular structure; very friable; many roots; few pebbles; slightly acid; abrupt, smooth boundary.

B21—9 to 16 inches, brown (10YR 4/3) silt loam; few, medium, faint, yellowish-brown (10YR 5/4) mottles; weak, medium, subangular blocky structure; friable; common roots; few pebbles; neutral; clear, wavy boundary.

B22—16 to 23 inches, dark-brown (10YR 4/3) silt loam; many, medium, faint, dark grayish-brown (10YR 4/2) mottles and few, medium, distinct, dark-gray (10YR

4/1) and light brownish-gray (10YR 6/2) mottles; weak, medium, subangular blocky structure; friable; few roots; few, medium, distinct, very dark brown (10YR 2/2) stains; few pebbles; mildly alkaline; clear, wavy boundary.

B23—23 to 29 inches, dark grayish-brown (10YR 4/2) silt loam; few, medium, faint, dark-gray (10YR 4/1) and pale-brown (10YR 6/3) mottles; weak, medium, subangular blocky structure; friable; few roots; few pebbles; mildly alkaline; gradual, wavy boundary.

B24—29 to 40 inches, dark grayish-brown (10YR 4/2) loam; common, medium, distinct, brown (10YR 5/3) and yellowish-red (5YR 4/6) mottles; massive; very friable; few roots; few pebbles; moderately alkaline; gradual, wavy boundary.

C1—40 to 63 inches, dark-gray (10YR 4/1) and dark grayish-brown (10YR 4/2) sandy loam; common, medium, distinct, brown (10YR 5/3) and yellowish-red (5YR 4/6) mottles; massive; very friable; few pebbles; moderately alkaline, calcareous; clear; wavy boundary.

C2—63 to 75 inches, yellowish-brown (10YR 5/4), brown (7.5YR 4/4), and gray (10YR 6/1) sand; single grained; loose; moderately alkaline, calcareous.

The thickness of the solum and the depth to free carbonates range from 24 to 40 inches. Reaction in the solum ranges from slightly acid to moderately alkaline. Depth to sand and gravel ranges from 5 to 8 feet.

The Ap horizon is dark grayish brown (10YR 4/2), dark brown (10YR 4/3), or brown (10YR 5/3). Profiles in undisturbed areas have a very dark gray (10YR 3/1) A1 horizon 1 to 3 inches thick.

The B horizon is mainly silt loam and loam, but in some places it is clay loam, sandy loam, sandy clay loam, or silty clay loam. It is mainly yellowish brown (10YR 5/4), dark yellowish brown (10YR 4/4), or dark brown (10YR 4/3), but in some places it is dark grayish brown (10YR 4/2) in the lower part. The B horizon has mottles with a chroma of 2 or less, mainly at a depth of 12 to 20 inches.

The C horizon ranges from dark gray (10YR 4/1) to brown (7.5YR 4/4) and has bright mottles. The lower part of the C horizon is highly stratified with thin, variable layers or seams of sandy loam, loamy sand, clay loam, or silty clay loam.

Eel soils are part of the drainage sequence that includes well-drained Stonelick and Genesee soils, somewhat poorly drained Shoals soils, and very poorly drained, dark-colored Sloan soils. Eel soils have a solum that is similar in texture to that of the Sardinia soils but is less acid. They lack a B2t horizon that is present in Thackery soils. Eel soils are less acid than Philo soils, and they lack the dark-colored underlying layer of the Algiers soils. Eel soils have gray mottles in the lower part of the solum, which Genesee soils lack.

Ee—Eel silt loam. This nearly level soil is on flood plains, commonly in elongated areas of 2 to more than 100 acres.

Included with this soil in mapping are spots of lighter-colored, well-drained Genesee soils and somewhat poorly drained Shoals soils. Included in some places are small areas of dark-colored, very poorly drained Sloan soils and light-colored Algiers soils that are dark colored below a depth of 12 to 20 inches. Also included are soils that have a surface layer of loam and sandy loam.

This soil has no important limitations for general farming. It is occasionally flooded, and controlling weeds is a concern in management. The soil is less suited to tobacco because it is moderately well drained, and tobacco grows better on well drained soils. Flooding is a severe limitation for many nonfarm uses. Capability unit IIw–5; woodland suitability group 1o1.

Fincastle Series

The Fincastle series consists of somewhat poorly drained, nearly level to gently sloping soils that formed in loess and the underlying glacial till. The Fincastle soils are on till plains. The native vegetation was hardwood forest, in which ash, maple, and elm were dominant.

In a representative profile in a cultivated area, the surface layer is dark grayish-brown silt loam 7 inches thick. The subsurface layer, to a depth of 11 inches, is yellowish-brown and pale-brown silt loam that has gray mottles. The subsoil extends to a depth of 47 inches. The upper 7 inches is dark yellowish-brown silty clay loam that has gray, grayish-brown, and yellowish-brown mottles. The next 8 inches is dark yellowish-brown silty clay loam that has yellowish-brown and grayish-brown mottles. The lower 21 inches is yellowish-brown clay loam that has grayish-brown mottles. The substratum, to a depth of 60 inches, is yellowish-brown and gray loam.

The available water capacity is high in Fincastle soils. Permeability is moderately slow, and surface runoff is slow. These soils have a high water table in winter and spring, and they dry out slowly after rain. The root zone is deep and is commonly slightly acid to strongly acid.

Fincastle soils are used for corn, soybeans, wheat, and grass-legume mixtures for hay and pasture. A small acreage is in permanent pasture or woodland.

Representative profile of Fincastle silt loam, in an area of Crosby-Fincastle silt loams, 0 to 2 percent slopes, in a cultivated field 2 miles south-southwest of East Monroe on Monroe Road, ½ mile south-southwest of the intersection of Monroe Road and Centerfield West Road, ½ mile north-northeast of the intersection of Monroe Road and Pausch Road, and 50 yards west of Monroe Road, in Fairfield Township:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, granular structure; very friable; many roots; few pebbles; slightly acid; abrupt, smooth boundary.

B&A—7 to 11 inches, yellowish-brown (10YR 5/4) and pale-brown (10YR 6/3) silt loam; common, fine and medium, distinct, gray (10YR 5/1) mottles; weak, medium, subangular blocky structure; friable; common roots; thin, patchy, light brownish-gray (10YR 6/2) silt coatings on vertical ped faces; few pebbles; strongly acid; clear, wavy boundary.

B1t—11 to 18 inches, dark yellowish-brown (10YR 4/4) silty clay loam; common, fine and medium, distinct, gray (10YR 5/1), grayish-brown (10YR 5/2), and yellowish-brown (10YR 5/8) mottles; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky; firm; common roots; thin, patchy, dark grayish-brown (10YR 4/2) clay films on vertical and horizontal ped faces; thin, continuous, light brownish-gray (10YR 6/2) silt coatings on vertical ped faces; few, fine, prominent, black (10YR 2/1) stains; 4 percent pebbles; strongly acid; clear, wavy boundary.

B21t—18 to 26 inches, dark yellowish-brown (10YR 4/4) silty clay loam; common, medium, distinct, yellowish-brown (10YR 5/6) and grayish-brown (10YR 5/2) mottles; weak, coarse, prismatic structure parting to moderate, medium and coarse, subangular blocky; firm; few roots; thin, continuous, dark grayish-brown (10YR 4/2) and dark-gray (10YR 4/1) clay films on vertical ped faces and thin, patchy, dark grayish-brown (10YR 4/2) and dark-gray (10YR 4/1) clay films on horizontal ped faces; common, fine, prominent, black (10YR 2/1) stains and concretions; 5 percent pebbles; strongly acid; gradual, wavy boundary.

IIB22t—26 to 38 inches, yellowish-brown (10YR 5/4) clay loam; many, medium, distinct, yellowish-brown (10YR 5/8) and grayish-brown (10YR 5/2) mottles; weak, coarse, subangular blocky structure; firm; thin, patchy, dark-gray (10YR 4/1) clay films on vertical ped faces; many, medium, prominent, black (10YR

2/1) stains and concretions; 8 percent pebbles; slightly acid; gradual, wavy boundary.

IIB3t—38 to 47 inches, yellowish-brown (10YR 5/4) clay loam; many, medium, distinct, yellowish-brown (10YR 5/8) and grayish-brown (10YR 5/2) mottles; weak, coarse, subangular blocky structure; firm; thin, very patchy, dark grayish-brown (10YR 4/2) clay films on vertical ped faces; few, fine, prominent, black (10YR 2/1) stains and concretions; 10 percent pebbles; mildly alkaline; clear, wavy boundary.

IIC—47 to 60 inches, yellowish-brown (10YR 5/6) and gray (10YR 5/1) loam; massive; firm and compact; few, fine, prominent, black (10YR 2/1) stains and concretions; 15 percent pebbles; mildly alkaline, calcareous.

The solum is 42 to 70 inches thick. The loess cap ranges from 20 to 40 inches in thickness but is typically 20 to 30 inches thick. Reaction in the solum ranges from strongly acid to medium acid in the B&A horizon, B1 horizon, and the upper part of the B2t horizon, and from strongly acid to mildly alkaline in the B3 horizon.

The Ap horizon is dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), or brown (10YR 4/3 and 5/3). Profiles in undisturbed areas have an A1 horizon, 2 to 5 inches thick, that is very dark gray (10YR 3/1), black (10YR 2/1), or very dark grayish brown (10YR 3/2). Some profiles have an A2 horizon that is typically brown (10YR 5/3), light yellowish brown (10YR 6/4), or yellowish brown (10YR 5/4). Where the A2 horizon is below the A1 horizon, it is 3 to 8 inches thick. Where the A2 horizon is below the Ap horizon, it is 2 to 4 inches thick.

The matrix of the B horizon has a hue of 10YR, value of 4 through 6, and chroma of 1 through 4. The dominant mottles in the B horizon have a hue of 10YR, value of 4 through 6, and chroma of 1 through 8. The B2t horizon is 20 to 45 inches thick. The upper part is silty clay loam, and the lower part, which formed in glacial till, is typically clay loam. Thin and medium, patchy and continuous clay films range from very dark grayish brown (10YR 3/2) to gray (10YR 5/1).

The C horizon is mainly yellowish brown (10YR 5/4 and 5/6) or brown (10YR 5/3).

Fincastle soils are part of the drainage sequence that includes well drained Russell soils, moderately well drained Xenia soils, and very poorly drained Brookston soils. Fincastle soils lack the fragipan that is in Avonburg and Dubois soils. They have a thicker loess cap, have a lower clay content in the B horizon, and are deeper to glacial till than Crosby soils. Fincastle soils are underlain by glacial till, but Fitchville and Sleeth soils are underlain by glacial outwash material. They have a coarser textured C horizon than McGary soils.

In Highland County, Fincastle soils are mapped only in complexes with Crosby soils.

Fitchville Series

The Fitchville series consists of somewhat poorly drained, nearly level to gently sloping soils. These soils formed in loess or loamy alluvium and stratified outwash and alluvium. They are on stream terraces. The native vegetation was hardwood forest in which elm, sycamore, ash, and maple were dominant.

In a representative profile in a cultivated area, the surface layer is dark grayish-brown silt loam 10 inches thick. The subsurface layer, to a depth of 15 inches, is brown silt loam that has gray and yellowish-brown mottles. The subsoil extends to a depth of 68 inches. The upper 7 inches is yellowish-brown silt loam that has gray and yellowish-brown mottles. The next 7 inches is gray silty clay loam that has yellowish-brown mottles. The next 8 inches is gray silt loam that has brown and yellowish-brown mottles. The next 10 inches is yellowish-brown silty clay loam that has gray and yellowish-brown mottles. The next 10 inches is grayish-brown clay loam that has gray and strong-brown mottles. The lower 11 inches is brown sandy clay loam that has strong-brown and gray mottles. The substratum, to a depth of 77 inches, is strong-brown and gray gravelly clay loam that has dark yellowish-brown mottles.

The available water capacity is medium to high in the Fitchville soils. Permeability is moderately slow, and surface runoff is slow to medium. These soils have a high water table in winter and spring, and they are slow to dry out after rain. The root zone is moderately deep to deep and is commonly slightly acid to strongly acid.

Fitchville soils are used mainly for corn, soybeans, wheat, and grass-legume mixtures for hay and pasture. A small acreage is in permanent pasture or woodland.

Representative profile of Fitchville silt loam, 0 to 2 percent slopes, in a cultivated field 2¾ miles northeast of Hillsboro, ¼ mile north of the intersection of State Route 138 and Selph Road, 330 yards west of Selph Road, and 350 yards north of Clear Creek, in Liberty Township:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure: very friable; many roots; neutral; abrupt, smooth boundary.

A2—10 to 15 inches, brown (10YR 5/3) silt loam; common, medium, distinct, gray (10YR 6/1) and yellowish-brown (10YR 5/6) mottles; moderate, medium and thick, platy structure; very friable; common roots; neutral; clear, wavy boundary.

B1t—15 to 22 inches, yellowish-brown (10YR 5/4) silt loam; common, medium, distinct, gray (10YR 6/1) and yellowish-brown (10YR 5/8) mottles; moderate, medium and fine, subangular blocky structure; friable; common roots; thin, patchy, dark yellowish-brown (10YR 4/4) clay films on horizontal and vertical ped faces; strongly acid; clear, wavy boundary.

B21t—22 to 29 inches, gray (10YR 6/1) silty clay loam; many, medium, distinct, yellowish-brown (10YR 5/4) mottles and common, fine, distinct, yellowish-brown (10YR 5/8) mottles; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; firm; few roots; common vesicular pores; thin, patchy, light olive-brown (2.5Y 5/4) clay films on horizontal and vertical ped faces; thin, patchy, pale-brown (10YR 6/3) and white (10YR 8/2 dry) silt coatings on vertical ped faces; strongly acid; gradual, wavy boundary.

B22t—29 to 37 inches, gray (10YR 5/1) silt loam; common medium, distinct, brown (7.5YR 5/4) and yellowish-brown (10YR 5/8) mottles; weak, medium, prismatic structure parting to moderate, medium, subangular blocky; firm; few roots; common to many vesicular pores; thin, patchy, brown (10YR 5/3) and light olive-brown (2.5Y 5/4) clay films on vertical and horizontal ped faces; thin, continuous, pale-brown (10YR 6/3) and white (10YR 8/2 dry) silt coatings on vertical and horizontal ped faces; strongly acid; abrupt, wavy boundary.

B31—37 to 47 inches, yellowish-brown (10YR 5/4) silty clay loam; common, medium, distinct, gray (10YR 6/1) and yellowish-brown (10YR 5/8) mottles; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; firm; thin, patchy, brown (10YR 5/3) clay films on vertical ped faces; common, medium, prominent, black (10YR 2/1) stains and concretions; 3 percent pebbles; medium acid; clear, wavy boundary.

IIB32—47 to 57 inches, grayish-brown (10YR 5/2) clay loam; common, fine and medium, gray (10YR 6/1) mottles and many, medium, distinct, strong-brown (7.5YR 5/6) mottles; weak, coarse, subangular blocky structure; firm; thin, very patchy, brown (10YR 5/3) clay films on vertical ped faces; few, fine, distinct, very dark brown (10YR 2/2) stains; 5 percent pebbles; slightly acid; abrupt, wavy boundary.

IIB33—57 to 68 inches, brown (7.5YR 5/4) sandy clay loam; common, medium, distinct, strong-brown (7.5YR 5/8) mottles and common, fine, distinct, gray (10YR 6/1) mottles; weak, coarse, subangular blocky structure; firm; many, medium, prominent, black (10YR 2/1)

stains and concretions; 15 percent pebbles; neutral; clear, wavy boundary.

IIIC1—68 to 77 inches, strong-brown (7.5YR 5/6) and gray (10YR 6/1) gravelly clay loam; common, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; massive; firm; few, medium, prominent, black (10YR 2/1) stains; 25 percent gravel; neutral; clear, wavy boundary.

IIIC2—77 to 90 inches, brown (10YR 5/3) gravelly loam; common, medium, distinct, gray (10YR 5/1) and yellowish-brown (10YR 5/8) mottles; massive; friable; partly weathered, dolomitic rocks that are light yellowish brown (10YR 6/4), brownish yellow (10YR 6/6), and light gray (10YR 7/1); 40 percent gravel, mildly alkaline, calcareous; clear, wavy boundary.

IIIC3—90 to 106 inches, grayish-brown (10YR 5/2) sand and gravel; single grained; loose; 15 percent pebbles; mildly alkaline, calcareous.

The solum is 50 to 70 inches thick, and the loess mantle is 10 to 30 inches thick. Reaction in the solum ranges from slightly acid to strongly acid from the surface through the B2t horizon and is slightly acid or neutral in the lower part.

The Ap horizon is dark grayish brown (10YR 4/2 and 2.5Y 4/2) or grayish brown (10YR 5/2 and 2.5Y 5/2). Profiles in undisturbed areas have a very dark gray (10YR 3/1) or very dark brown (10YR 2/2) A1 horizon 2 to 6 inches thick. The A2 horizon is brown (10YR 4/3 and 5/3), grayish brown (10YR 5/2), or light brownish gray (10YR 6/2) and is 3 to 8 inches thick.

The B1t and B2t horizons have a hue of 7.5YR and 10YR, value of 4 through 6, and chroma of 1 through 6, and they have mottles of gray (10YR 6/1 and 5/1) and grayish brown (10YR 5/2). They are silt loam, silty clay loam, clay, and sandy clay loam. Thin, patchy to very patchy clay films that are neutral or have a hue of 10YR and 2.5Y and a chroma as high as 4 are on ped surfaces in the B2t horizon. In some places silt coatings that have a hue of 10YR, value of 6 through 8, and chroma of 1 through 4 are in the upper part of the B2t horizons.

The B3 and C horizons have a hue of 10YR and 7.5YR, value of 4 and 5, and chroma of 1 through 6. They have mottles that have a hue of 10YR, value of 4 through 6, and chroma of 1 through 8. These horizons show evidence of stratification and are clay, silty clay loam, clay loam, sandy clay loam, loam, and sandy loam; in places they are gravelly.

Fitchville soils are part of the drainage sequence that includes well drained Williamsburg soils, moderately well drained Sardinia soils, and very poorly drained Patton soils. Fitchville soils are not so deeply leached and lack the fragipan of Dubois soils. They lack the fragipan and underlying glacial till of Avonburg soils. Fitchville soils have a lower content of clay in the B horizon than McGary soils, and they lack the underlying glacial till of Crosby and Fincastle soils.

FcA—Fitchville silt loam, 0 to 2 percent slopes. This nearly level to slightly depressional soil is in narrow to moderately broad, somewhat irregularly shaped areas of 3 to 20 acres. It is between better drained Sardinia or Williamsburg soils and dark-colored Westland soils. It is closely associated with Fox and Ockley soils on terraces and Genesee soils on flood plains.

This soil has the profile described as representative of the series. It is commonly near sloping areas or escarpments and periodically receives seepage and inwash of surface water. The deposition of silty material makes the surface layer thicker.

Included with this soil in mapping are a few areas of dark-colored Westland soils in narrow strips along waterways and in small depressions at the head of drainageways.

Wetness is a moderate limitation if this soil is farmed. The surface layer and the upper layers of the subsoil have a high content of silt. They puddle when wet, crust when dry, and heave during winter freezing. These soil characteristics can cause reduced germination of seeds, poor emergence of plants, and frost kill of small grains. Crops are damaged most during periods of excessive wetness Wetness is also a limitation for nonfarm uses. Capability unit IIw–2, woodland suitability group 2w2.

FcB—Fitchville silt loam, 2 to 6 percent slopes. This gently sloping soil is in narrow to moderately broad, somewhat irregularly shaped areas of 3 to 20 acres. It is between better drained Sardinia or Williamsburg soils and dark-colored Westland soils. A large acreage on terraces is in relatively narrow, short, elongated strips along streams. The soil is closely associated with Fox and Ockley soils on terraces and Genesee soils on flood plains. This soil is commonly near sloping areas or escarpments and periodically receives seepage and inwash of surface water.

Included with this soil in mapping are a few areas of dark-colored Westland soils in narrow strips along small drainageways and in slight depressions at the head of drainageways. Also included are some moderately eroded spots. In these spots the surface layer is a mixture of the original surface layer and the upper part of the brown subsoil. Moderately well drained Sardinia soils are included in the more sloping areas.

Wetness, crusting, and the hazard of erosion are limitations of this soil for farming. Wetness is a limitation for some nonfarm uses. Capability unit IIw-2; woodland suitability group 2w2.

Fox Series

The Fox series consists of well-drained, nearly level to moderately steep soils. These soils formed in a thin loess cap, outwash material, and the underlying sand and gravel.

They are on stream terraces, outwash plains, kames, and eskers. The native vegetation was hardwood forest in which hickory, oak, and maple were dominant.

In a representative profile in a cultivated area, the surface and subsurface layers are dark grayish-brown silt loam 13 inches thick. The subsoil extends to a depth of 39 inches. The upper 5 inches is yellowish-brown and dark-brown silt loam. The next 9 inches is yellowish-brown clay loam. The lower 12 inches is yellowish-brown gravelly clay loam. The substratum, to a depth of 60 inches, is brown, loose sand and gravel.

The available water capacity is medium in Fox soils. Permeability is moderate in the subsoil and moderately rapid in the substratum. Surface runoff is slow to rapid. The root zone is moderately deep and is slightly acid to strongly acid.

Fox soils are used mainly for corn, wheat, and grass-legume mixtures for hay and pasture. Some soybeans and tobacco are also grown. A small acreage is in permanent pasture and woodland.

Representative profile of Fox silt loam, 2 to 6 percent slopes, in a cultivated field 3¾ miles east of Hillsboro on U.S. Highway 50, ⅜ mile north on Petersburg Road, and ¼ mile west and 45 yards south of Carroll Lane, in Liberty Township:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; friable; many roots; few pebbles; medium acid; abrupt, smooth boundary.

A2—9 to 13 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, subangular blocky structure; friable; common roots; few pebbles; medium acid; clear, wavy boundary.

IIB1—13 to 18 inches, yellowish-brown (10YR 5/4) and dark-brown (10YR 4/3) silt loam; weak, fine and medium, subangular blocky structure; friable; common roots; 5 percent pebbles; medium acid; clear, wavy boundary.

IIB21t—18 to 27 inches, yellowish-brown (10YR 5/4) clay loam; moderate, fine and medium, subangular blocky structure; firm; few roots; thin, patchy, brown (7.5YR 4/4) clay films on vertical and horizontal ped faces; 15 percent pebbles; strongly acid; clear, wavy boundary.

IIB22t—27 to 39 inches, yellowish-brown (10YR 5/4) gravelly clay loam; common, medium, faint, yellowish-brown (10YR 5/8) mottles; weak, medium and coarse, subangular blocky structure; firm; few roots; thin, patchy, dark grayish-brown (2.5YR 4/2) and grayish-brown (2.5YR 5/2) clay films on vertical and horizontal ped faces; common, fine, prominent, black (10YR 2/1) stains and concretions; 30 percent gravel; slightly acid; abrupt, irregular boundary.

IIC—39 to 60 inches, brown (10YR 4/3) sand and gravel; single grained; loose; few roots; stains and mottled colors of decomposed stones are brownish yellow (10YR 6/6), pale brown (10YR 6/3), and grayish brown (10YR 5/2); 50 percent gravel; mildly alkaline, calcareous.

The thickness of the solum and the depth to calcareous sand and gravel are 24 to 40 inches. The loess mantle ranges from 0 to 18 inches in thickness, but is typically 6 to 12 inches thick. Reaction in the solum is medium acid to slightly acid in the A horizon and medium acid to strongly acid in the upper part of the B2t horizon; it ranges from slightly acid to neutral in the lower part of the B2t horizon and in the B3 horizon.

The A horizon is silt loam, loam, or clay loam. The Ap horizon is dark grayish brown (10YR 4/2), dark brown (10YR 4/3), brown (10YR 5/3), or yellowish brown (10YR 5/4). Profiles in undisturbed areas have an A1 horizon that is very dark grayish brown (10YR 3/2), very dark brown (10YR 2/2), or very dark gray (10YR 3/1) and is 4 to 7 inches thick. The A2 horizon is dark grayish brown (10YR 4/2), brown (10YR 5/3 and 4/3), or yellowish brown (10YR 5/4) and is 2 to 6 inches thick.

The B1, B2t, and C horizons typically have a hue of 10YR and 7.5YR, value of 4 and 5, and chroma of 3 through 6. The B1t and B2t horizons range from 14 to 34 inches in thickness but are typically 18 to 26 inches thick. The B2t horizon is clay loam, silty clay loam, loam, or sandy clay loam and is gravelly in places. The content of gravel is 10 to 35 percent. The B2t horizon contains thin, patchy and very patchy clay films that have a hue of 7.5 YR, 10YR, and 2.5Y, value of 3 through 5, and chroma of 2 through 4. In some places tongues of material from the B2t or B3 horizon extend 3 to 10 inches or more into the C horizon.

In Fox soils the underlying calcareous sand and gravel is at a depth of 24 to 42 inches, but in Casco soils it is at a depth of 10 to 24 inches, and in Ockley soils it is at a depth of 42 to 60 inches. Fox soils have a B horizon, which Stonelick soils lack. They lack a dark-colored Ap or A1 horizon, which Warsaw soils have. Fox soils have a solum similar to that of Kendallville soils, but Kendallville soils are underlain by loam till. Fox soils have a solum that is not so deeply leached, is thinner, and is not so red as that of Negley soils.

FlC2—Fox loam, 6 to 12 percent slopes, moderately eroded. This sloping soil is on short, narrow terraces along streams and on hills in the uplands. Areas are irregularly shaped, and most cover 3 to 15 acres. This soil has a profile similar to the one described as representative of the series, but its surface layer is loam, is browner, and is a mixture of the original surface layer and the upper part of the subsoil.

Included with this soil in mapping are severely eroded areas; areas where the surface layer is sandy loam and contains a large amount of gravel; small, shallow gullies; and Casco soils that have calcareous sand and gravel at a depth of less than two feet. Also included are some uneroded wooded areas that have a surface layer of silt loam. Spots of Ockley and Kendallville soils that have a surface layer of silt loam and are mostly in the uplands are also included.

Slope, droughtiness, and erosion are limitations for crops and irrigation and for nonfarm uses. Capability unit IIIe–4; woodland suitability group 2o1.

FlD2—Fox loam, 12 to 18 percent slopes, moderately eroded. This moderately steep soil is on short, narrow terraces along streams and on hills in the uplands. It has a profile similar to the one described as representative for the series, but its surface layer is loam, is browner and more droughty, and is a mixture of the original surface layer and subsoil material.

Included with this soil in mapping are severely eroded areas that have a surface layer of sandy loam and gravelly loam, gullied areas, and more droughty Casco soils that have limy sand and gravel at depths of less than two feet. Some included areas that have been kept in forest or pasture are only slightly eroded.

Slope, the severe hazard of erosion, and droughtiness are limitations for farming and for nonfarm uses. Some areas of this soil are idle and are reverting to low-quality forest, and others are now in permanent pasture. Capability unit IVe–4; woodland suitability group 2r1.

FnA—Fox silt loam, 0 to 2 percent slopes. This nearly level to slightly concave or depressional soil is on stream terraces in areas that are 175 to 1,300 feet wide and as much as ¾ of a mile long and cover 5 to 60 acres. It is also in the uplands.

This soil has a profile similar to the one described as representative of the series, but its surface layer is grayer. Most areas receive seepage and runoff from adjacent sloping soils, which has made the surface layer thicker and the soil deeper to calcareous sand and gravel.

Included with this soil in mapping are small areas of Ockley and Thackery soils. Also included are small areas that have a surface layer of loam or sandy loam that is gravelly in places.

This soil has few limitations for farming, except for droughtiness. It is well suited to special crops and to irrigation, and it is well suited to many nonfarm uses. Capability unit IIs–1; woodland suitability group 2o1.

FnB—Fox silt loam, 2 to 6 percent slopes. This gently sloping soil is on stream terraces in areas that are 175 to 1,300 feet wide and as much as ¾ of a mile long and cover 5 to 60 acres. It is also on hills in the uplands. This soil has the profile described as representative of the series. Some areas receive seepage and runoff from adjacent sloping soils.

Included with this soil in mapping are areas that have a thicker surface layer and are deeper to sand and gravel than the representative profile because of the deposition of material eroded from the adjacent soils. Also included are some moderately eroded areas, some small areas that have a surface layer of loam and sandy loam, and some gravelly spots. Small areas of poorly drained, dark-colored Westland soils are included in depressions, at the head of waterways, and in narrow strips along small waterways.

This soil is well suited to farming, particularly special crops, and is well suited to irrigation, but the hazard of erosion is moderate. The soil is also well suited to many nonfarm uses. Capability unit IIe–3; woodland suitability group 2o1.

FoC3—Fox clay loam, 6 to 12 percent slopes, severely eroded. This sloping soil is on the short terraces in narrow bands along streams and in the uplands. Areas cover 5 to 15 acres. There are many small, shallow gullies and some larger gullies that cannot be crossed by farm equipment. Nearly all of the original surface layer has been removed through erosion, and the present surface layer consists mostly of subsoil material.

Included with this soil in mapping are areas where the surface layer is sandy loam and contains gravel and shallower, droughty Casco soils. This soil is suited to pasture or forest. Most areas are idle and are reverting to forest, but some have been renovated for permanent pasture. Slope and erosion are limitations for crops and for many nonfarm uses. Capability unit IVe–4; woodland suitability group 2o1.

Gasconade Series

The Gasconade series consists of well-drained, sloping to very steep soils that formed in residuum weathered from limestone. These soils are on unglaciated uplands and in glaciated areas that lack a till mantle. The native vegetation was deciduous and coniferous forest of locust, hickory, oak, and redcedar.

In a representative profile in a cultivated area, the surface layer is black silty clay loam 7 inches thick. The subsoil, to a depth of 13 inches, is flaggy and channery silty clay. The substratum, to a depth of 15 inches, is light yellowish-brown flaggy and channery loam. Limestone bedrock is at a depth of 15 inches.

The available water capacity is very low in Gasconade soils. Permeability is moderately slow, and surface runoff is medium to rapid. The root zone is shallow and is neutral to moderately alkaline.

The steeper Gasconade soils are mostly in forest. The stony, less sloping soils are used for corn, wheat, and grass-legume mixtures for hay and pasture. A large acreage is idle and is reverting to forest.

Representative profile of Gasconade silty clay loam, 6 to 12 percent slopes, in a cultivated area 1 mile south-southeast of Boston on Beechwood Road and 330 yards east of Beechwood Road, in Paint Township:

Ap—0 to 7 inches, black (10YR 2/1) silty clay loam; moderate, fine and medium, subangular blocky structure; firm; many roots; common tubular and vesicular pores; 15 percent limestone fragments; mildly alkaline; clear, smooth boundary.

B—7 to 13 inches, dark grayish-brown (10YR 4/2) flaggy and channery silty clay; common, medium, distinct, dark yellowish-brown (10YR 4/4) mottles; strong, fine and medium, angular blocky structure; very firm; common roots; common tubular and vesicular pores; 25 percent limestone fragments; mildly alkaline, calcareous; abrupt, wavy boundary.

C—13 to 15 inches, light yellowish-brown (10YR 6/4) flaggy and channery loam; common, medium, prominent, strong-brown (7.5YR 5/6) mottles and few, fine, faint, light brownish-gray (10YR 6/2) mottles; massive; friable; few roots; 50 percent limestone fragments; mildly alkaline, calcareous; abrupt, wavy boundary.

R—15 inches, limestone bedrock.

The solum is 9 to 18 inches thick and is weakly developed. The limestone bedrock is at a depth of 9 to 20 inches. Reaction ranges from neutral to mildly alkaline through the solum.

The Ap or A1 horizon is 4 to 10 inches thick and is black (10YR 2/1), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2).

The B horizon is typically flaggy and channery silty clay or flaggy and channery clay, but in some places it contains silty clay loam. It ranges from 4 to 12 inches in thickness but is commonly 4 to 10 inches thick. The B horizon is typically dark yellowish brown (10YR 4/4) or dark brown (10YR 4/3), but it is dark grayish brown (10YR 4/2) in some places.

The thin C horizon is partly weathered limestone material. It is light yellowish brown (10YR 6/4) or pale brown (10YR 6/3) to light brownish gray (10YR 6/2). It has mottles in a hue of 10YR and 7.5YR, value of 5 and 6, and chroma of 2 to 6.

Gasconade soils, unlike Opequon soils, have a dark-colored A horizon and lack a B2t horizon. They are underlain by limestone bedrock, and Colyer soils are underlain by shale bedrock. Gasconade soils have better natural drainage and are shallower to limestone bedrock than Millsdale soils.

GaC—Gasconade silty clay loam, 6 to 12 percent slopes. This sloping soil is in both the glaciated and the residual parts of the county. It is along minor drainageways and in oval or fan-shaped areas at the head of drainageways, and it is next to steeper soils downstream. Areas range from 2 to 33 acres, but most are 3 to 10 acres. Slopes are convex and are mainly 150 feet to 400 feet long.

This soil has the profile described as representative of the series. Cracks, ⅛ to ½ inch wide, open in the surface during dry periods. The soil is quite cloddy if it is cultivated when too wet.

Included with this soil in mapping are moderately eroded and severely eroded spots. In the severely eroded spots, there are many gullies, bedrock outcrops, and rock fragments, and the texture of the surface layer varies. The bedrock outcrops and rock fragments, however, do not seriously interfere with cultivation. Also included are less sloping areas, spots of light-colored Milton soils in the Wisconsin glaciated areas, and Opequon or Bratton soils in the Illinoian glaciated areas and residual areas.

The severe hazard of erosion is the major limitation for crops. Shallowness to bedrock is a major limitation for most nonfarm uses. Capability unit IVe–6; woodland suitability group 4d1.

GaD2—Gasconade silty clay loam, 12 to 18 percent slopes, moderately eroded. This moderately steep soil is along minor drainageways and in oval or fan-shaped areas at the head of drainageways. It is next to steeper soils downstream. Areas range from 3 to 13 acres, but most are only 3 to 8 acres. Slopes are convex and are mainly 150 to 400 feet long.

This soil has a profile similar to the one described as representative of the series, but its dark-colored surface layer is thinner and contains more limestone fragments. During dry seasons, many cracks, ⅛ to ½ inch wide, open in the surface.

Included with this soil in mapping are Opequon soils and severely eroded spots. The severely eroded spots have limestone fragments in the surface layer, shallow to deep gullies, and a surface layer of silty clay or clay. During wet seasons, there are many seep areas at the base of the slopes.

This soil is suited to permanent pasture or woodland. Slope and shallowness to bedrock are severe limitations for most nonfarm uses. Capability unit VIs–1; woodland suitability group 4d2.

GbF2—Gasconade flaggy silty clay loam, 18 to 35 percent slopes, moderately eroded. This steep to very steep soil is mainly along streams and at the head of drainageways, where it joins steeper soils downstream. Areas are narrow and mainly elongated, and they run laterally along drainageways for several hundred feet.

They cover 2 to 20 acres. Slopes are convex and are 85 to 200 feet long.

This soil has a profile similar to the one described as representative of the series, but its surface layer is thinner and is a mixture of the original surface layer and the upper part of the subsoil. Cracks form in the surface layer during dry seasons.

Included with this soil in mapping are severely eroded spots, some slightly concave or benchlike colluvial areas, and some small, steep and very steep bedrock escarpments. Seep areas and springs are at the middle or base of the slopes. Large isolated limestone blocks are included in some places.

This soil is suited to permanent pasture or woodland. Slope, shallowness to bedrock, erosion, droughtiness, and the content of rock fragments are severe limitations for most nonfarm uses. Capability unit VIIs–1; woodland suitability group 4x1.

GbG—Gasconade flaggy silty clay loam, 35 to 50 percent slopes. This very steep soil is in the uplands. Areas are commonly 150 to 650 feet wide and are mainly elongated. They cover 10 to 50 acres.

Included with this soil in mapping are small areas of light-colored Opequon soils, some slightly concave or benchlike colluvial areas, and bedrock escarpments. Seep areas and springs are at the middle or base of the slopes. Large isolated limestone blocks are included in some places.

This soil is well suited to woodland, but its very steep slopes limit the use of machinery. Slope and shallowness to bedrock are severe limitations for most nonfarm uses. Capability unit VIIs–1; woodland suitability group 4x1.

Genesee Series

The Genesee series consists of well-drained, nearly level soils that formed in alluvial material. The Genesee soils are on flood plains. The native vegetation was hardwood forest in which elm, sycamore, and ash were dominant.

In a representative profile in a cultivated area, the surface layer is dark grayish-brown silt loam 7 inches thick. The subsoil extends to a depth of 33 inches. The upper 15 inches is dark-brown silt loam, and the lower 11 inches is dark grayish-brown silt loam. The substratum, to a depth of 57 inches, is dark grayish-brown and brown silt loam and loam and, to a depth of 74 inches, is sandy loam.

The available water capacity is high in Genesee soils. Permeability is moderate. Surface runoff is slow, and the soils are subject to flooding. The root zone is deep and is slightly acid to moderately alkaline.

Genesee soils are used mostly for corn, soybeans, wheat, and some tobacco. Where flooding is more frequent, the soils are used more for hay and pasture (fig. 4) and woodland. Few acres of Genesee soils are left idle.

Representative profile of Genesee silt loam, in a cultivated field 1.1 miles south-southwest of Mowrystown on Sardinia and Five Point Roads, 330 yards east-northeast of farm lane, and 150 feet north of the East Fork of White Oak Creek, in White Oak Township:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; few roots; common vesicular pores; mildly alkaline; abrupt, smooth boundary.

Figure 4.—**Pasture on Genesee soils; generally the grazing season is long and the yields are high.**

B1—7 to 12 inches, dark-brown (10YR 4/3) silt loam; moderate, thick, platy structure; friable; few roots; common vesicular pores; mildly alkaline; clear, smooth boundary.

B21—12 to 22 inches, dark-brown (10YR 4/3) silt loam; weak, very thick, platy structure; friable; few roots; common tubular pores; mildly alkaline; clear, wavy boundary.

B22—22 to 33 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium and coarse, subangular blocky structure; friable; few roots; moderately alkaline; diffuse, smooth boundary.

C1—33 to 47 inches, dark grayish-brown (10YR 4/2) silt loam; weak, coarse, subangular blocky structure; friable; few roots; moderately alkaline, calcareous; gradual, smooth boundary.

C2—47 to 57 inches, brown (10YR 4/3) loam; very weak, coarse, subangular blocky structure; friable; few roots; moderately alkaline, calcareous; clear, wavy boundary.

C3—57 to 74 inches, brown (10YR 4/3) sandy loam; massive; friable; few, medium, distinct, gray (10YR 5/1) root and worm channels that have dark-brown (7.5YR 4/4) coatings; few roots; moderately alkaline, calcareous; abrupt, wavy boundary.

The solum is 24 to 40 inches thick. Reaction ranges from slightly acid to moderately alkaline but is dominantly neutral to moderately alkaline.

The Ap horizon is dark grayish brown (10YR 4/2), brown (10YR 5/3), or dark brown (10YR 4/3). The B horizon is dominantly silt loam and loam, but in places it is clay loam and silty clay loam. The B and C horizons are dominantly dark brown (10YR 4/3), brown (10YR 5/3), and dark grayish brown (10YR 4/2), but in places they are yellowish brown (10YR 5/4). In some places the lower part of the C horizon has thin strata of sandy loam, loamy sand, or silty clay loam.

Genesee soils are part of the drainage sequence that includes well drained Stonelick soils, moderately well drained Eel soils, somewhat poorly drained Shoals soils, and very poorly drained Sloan soils. Genesee soils have a higher base saturation and are less acid in the solum than Philo soils. They lack the dark-colored A horizon of Ross soils and lack the Bt horizon of Ockley and Williamsburg soils.

Gn—Genesee silt loam. This nearly level soil is on the flood plains. Areas commonly range from 2 acres to more than 200 acres.

Included with this soil in mapping are Stonelick and Ross soils and some less well drained alluvial soils adjacent to uplands or terraces. Also included are areas of a more silty soil. These areas are along the Middle Fork of Ohio Brush Creek and Baker's Fork in Brush Creek Township, along Rocky Fork in Paint Township, and along Elm Run in Jackson Township. In some places limestone bedrock is within 40 inches of the surface.

This soil is subject to occasional flooding. Along smaller streams it is commonly used for tobacco, but the hazard of flooding and need for weed control are limitations for this use. The soil is not subject to erosion and can be farmed intensively without loss of soil material. The hazard of flooding is a severe limitation for nonfarm uses. Capability unit IIw-5; woodland suitability group 1o1.

Grayford Series

The Grayford series consists of well-drained, gently sloping soils. These soils formed in loess, Illinoian glacial till, and clayey residuum weathered from limestone. They are on glaciated uplands. The native vegetation was hardwood forest in which maple, oak, hickory, and yellow-poplar were dominant.

In a representative profile in a cultivated area, the surface layer is brown silt loam 7 inches thick. The subsoil extends to a depth of 56 inches. The upper 5 inches is yellowish-brown silt loam. The next 14 inches is yellowish-brown silty clay loam. The next 8 inches is brown clay. The next 15 inches is yellowish-red clay. The lower 7 inches is dark-brown clay. The substratum, to a depth of 59 inches, is light yellowish-brown sandy loam. Limestone bedrock is at a depth of 59 inches.

The available water capacity is medium in Grayford soils. Permeability is moderate, and surface runoff is medium. The root zone is deep and is slightly acid to very strongly acid.

Grayford soils are used mainly for corn, wheat, and soybeans. The more sloping soils are used extensively for hay, pasture, and woodland. A large acreage of more sloping, eroded Grayford soils is idle and is reverting to woodland.

Representative profile of Grayford silt loam, in an area of Boston-Grayford silt loams, 2 to 6 percent slopes, moderately eroded, in a cultivated field 2½ miles north of the Adams County line, ¾ mile west-northwest of Fairfax, ⅛ mile north of Fair Ridge Road, and 300 feet east of Beatty Road, in Concord Township:

Ap—0 to 7 inches, brown (10YR 4/3) silt loam; weak, fine and medium, subangular blocky structure; friable; many roots; neutral; abrupt, smooth boundary.

B1—7 to 12 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, subangular blocky structure; friable; common roots; 8 percent tubular pores; brown to dark-brown (10YR 4/3) krotovinas; slightly acid; clear, wavy boundary.

B21t—12 to 21 inches, yellowish-brown (10YR 5/4) silty clay loam; moderate, medium and coarse, subangular blocky structure; friable; common roots; common tubular pores; thin, very patchy, brown to dark-brown (7.5YR 4/4) clay films on ped faces; strongly acid; clear, wavy boundary.

IIB22t—21 to 26 inches, yellowish-brown (10YR 5/4) silty clay loam; weak, coarse, subangular blocky structure parting to moderate, fine, subangular blocky; friable; few roots; common tubular pores; thin, very patchy brown to dark brown (7.5YR 4/4) clay films on ped faces; thin, very patchy, pale-brown (10YR 6/3) silt coatings on vertical ped faces; fine, medium, distinct, black (10YR 2/1) concretions and stains; 5 percent pebbles; strongly acid; clear, wavy boundary.

IIB23t—26 to 34 inches, brown (7.5YR 5/4) clay; weak, coarse, subangular blocky structure parting to moderate, fine, angular and subangular blocky; firm; few roots; common tubular and vesicular pores; thin, patchy, brown to dark-brown (7.5YR 4/4) clay films on vertical and horizontal ped faces; thin, patchy, reddish-yellow (7.5YR 6/6) and very pale brown (10YR 7/3 dry) silt coatings on ped faces; common, medium, distinct, black (10YR 2/1) concretions and stains; 8 percent igneous pebbles; strongly acid; clear, smooth boundary.

IIIB24t—34 to 39 inches, yellowish-red (5YR 5/6) clay; weak, coarse, subangular blocky structure parting to moderate, very fine, angular blocky; very firm; few roots; few tubular pores; thin, patchy, reddish-brown (5YR 4/4) clay films on vertical ped faces and thin, very patchy, reddish-brown (5YR 4/4) clay films on horizontal ped faces; thin, very patchy, reddish-yellow (7.5YR 6/6) silt coatings on vertical ped faces; fine, medium, distinct, black (10YR 2/1) concretions and stains; 5 percent limestone fragments; strongly acid; gradual, smooth boundary.

IIIB25t—39 to 49 inches, yellowish-red (5YR 4/6) clay; weak, coarse, subangular blocky structure parting to moderate, very fine, angular blocky; very firm; few roots; few tubular pores; thin, patchy, reddish-brown (5YR 4/4) clay films on vertical ped faces and thin, very patchy, reddish-brown (5YR 4/4) clay films on horizontal ped faces; common, medium, distinct,

black (10YR 2/1) concretions and stains; 5 percent limestone fragments; medium acid; clear, smooth boundary.

IIIB3t—49 to 56 inches, dark-brown (7.5YR 4/4) clay; weak, coarse subangular blocky structure; firm; few tubular pores; thin, very patchy, brown to dark-brown (10YR 4/3) clay films on ped faces; 5 percent limestone fragments; slightly acid; clear, wavy boundary.

IIIC—56 to 59 inches, light yellowish-brown (10YR 6/4) sandy loam; massive; friable; mildly alkaline, calcareous; abrupt, wavy boundary.

IVR—59 inches, dolomitic limestone bedrock.

The thickness of the solum and the depth to limestone bedrock is 3½ to 8 feet. The loess is 20 to 40 inches thick, and the glacial till is 12 to 30 inches thick. The depth to limestone residuum is 36 to 48 inches. The Ap and Bl horizons are medium acid to neutral. The B2t horizons is medium acid to very strongly acid, and the lower horizons are medium acid to mildly alkaline.

The Ap horizon is brown (10YR 5/3), dark brown (10YR 4/3), or dark grayish brown (10YR 4/2).

The B1 horizon and the upper part of the B2t horizon are mainly dark brown (7.5YR 4/4) to dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4 and 5/6). The B2t, IIB2t, IIIB2t, and IIIB3t horizons are silty clay loam, clay loam, silty, clay, or clay.

In many places there is a C horizon that is 1 to 6 inches thick and is gray (10YR 6/1), pale brown (10YR 6/3), or light yellowish brown (10YR 6/4).

The limestone residuum is dominantly reddish brown (5YR 4/4) to yellowish red (5YR 4/6, 5/6, and 4/8), but in some places it is dark brown (7.5YR 4/4) or red (2.5YR 4/6) and reddish brown (2.5YR 4/4).

Grayford soils, unlike Russell soils, formed partly in limestone residuum. Grayford soils lack the fragipan of Rossmoyne, Cincinnati, and Boston soils. They have a thicker loess cap and less clay, and they are yellower in the B horizon and deeper to limestone bedrock than Bratton soils.

In Highland County, Grayford soils are mapped only in complexes with Boston soils.

Guernsey Series

The Guernsey series consists of moderately well drained, gently sloping to steep soils. These soils formed in thin loess and the underlying residuum weathered from clay shale in most places, but in some places they formed in colluvium over shale bedrock. The Guernsey soils are on uplands; they are mainly in the unglaciated part of the county, but they are also in the part of the county that was covered by the Illinoian glaciation but that lacks till. The native vegetation was hardwood forest in which oak, maple, and beech were dominant.

In a representative profile in a cultivated area, the surface layer is dark grayish-brown silt loam 6 inches thick. The subsoil extends to a depth of 34 inches. The upper 5 inches is yellowish-brown silt loam. The next 7 inches is yellowish-brown silty clay loam. The next 8 inches is light yellowish-brown silty clay that has grayish-brown and light olive-brown mottles. The lower 8 inches is grayish-brown silty clay that has light olive-brown mottles. The substratum, to a depth of 48 inches, is pale-olive and yellowish-brown silty clay that has gray mottles. Shale bedrock is at a depth of 48 inches.

The available water capacity is medium in Guernsey soils. Permeability is moderately slow to slow, and surface runoff is medium to rapid. The root zone is moderately deep and is medium acid to strongly acid.

Guernsey soils are used mostly for pasture and hay. Some of the less eroded and less sloping soils are used for corn, small grains, and some tobacco. A large acreage of the more eroded and steeper Guernsey soils is idle and is reverting to woodland.

Representative profile of Guernsey silt loam, 6 to 12 percent slopes, in a pasture ⅘ mile north of Elmville, ½ mile west of Elmville North Road, 135 yards south of Setty Creek, and 100 yards east-northeast of small barn, in Brush Creek Township:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine and medium, granular structure; friable; many roots; few pebbles; slightly acid; abrupt, smooth boundary.

B1—6 to 11 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, subangular blocky structure; friable; common roots; dark grayish-brown (10YR 4/2) organic stains in old root channels, in pores, and on some ped faces; few pebbles; medium acid; clear, wavy boundary.

B21t—11 to 18 inches, yellowish-brown (10YR 5/4) silty clay loam; weak, medium and coarse, subangular blocky structure parting to moderate, fine, angular and subangular blocky; firm; few roots; thin, patchy, brown and dark-brown (7.5YR 4/4) clay films on ped faces; few pebbles; medium acid; clear, wavy boundary.

IIB22t—18 to 26 inches, light yellowish-brown (2.5Y 6/4) silty clay; common, medium, distinct, grayish-brown (2.5Y 5/2) mottles and few, fine, faint, light olive-brown (2.5Y 5/6) mottles; weak, medium and coarse, subangular blocky structure; firm; thin, patchy, yellowish-brown (10YR 5/4) and brown (7.5YR 4/4) clay films on ped faces; 5 percent fragments; slightly acid; clear, wavy boundary.

IIB3t—26 to 34 inches, grayish-brown (2.5Y 5/2) silty clay; common, fine and medium, distinct, light olive-brown (2.5Y 5/6) mottles; weak, medium and coarse, subangular blocky structure; very firm; gray (N 6/0) and light yellowish-brown (2.5Y 6/4) clay films on ped faces; 5 percent fragments; neutral; abrupt, smooth boundary.

IIC1—34 to 48 inches, pale-olive (5Y 6/4) and yellowish-brown (10YR 5/4 and 5/6) silty clay; common, medium, distinct, gray (5Y 6/1) mottles; weak to moderate, medium to thick, platy structure; very firm; light olive-brown (2.5Y 5/4) and grayish-brown (2.5Y 5/2) clay films on ped faces; 10 precent fragments; mildly alkaline, calcareous.

IIC2—48 to 60 inches, soft shale bedrock.

The solum is 30 to 60 inches thick, and the loess cap is 4 to 18 inches thick. The depth to shale bedrock ranges from 3½ to 7 feet. Reaction is medium acid or strongly acid in the A and B1 horizons and in the upper part of the IIB2t horizon and is slightly acid or neutral in the lower part of the IIB2t horizon and in the IIB3t horizon. It is mildly alkaline to moderately alkaline in the C horizon.

The Ap horizon is dark grayish brown (10YR 4/2), grayish brown (10YR 5/3), or dark brown (10YR 4/3). The B1 and B2t horizons have weak and moderate, angular and subangular blocky structure. The B1 and B21t horizons are yellowish brown (10YR 5/4 and 5/6) or light yellowish brown (10YR 6/4). The B21t horizon is heavy silt loam and silty clay loam, and the IIB22t and IIB3t horizons are silty clay loam and silty clay. The B22t, B3t, and C horizons have a hue of 5Y, 2.5Y, and 10YR, value of 4 through 6, and chroma of 1 through 6.

Guernsey soils have a thinner loess mantle and a less acid solum than Loudon soils, and they lack glacial till material. They lack the limestone colluvial material of Beasley soils.

GuB—Guernsey silt loam, 2 to 6 percent slopes. This gently sloping soil is downslope from steeper Opequon soils and upslope from soils on terraces and flood plains. It is closely, associated with Lawshe and Beasley soils. Areas are slightly concave and cover 2 to 10 acres. Slopes are short to medium. This soil has a profile similar to the one described as representative of the series, but its surface layer is thicker and is somewhat grayer.

Included with this soil in mapping are a few areas of dark-colored Lawshe soils at the head of drainageways and in narrow bands along drainageways and a few small areas of Beasley soils. Also included are a few spots that are moderately eroded. The surface layer in these spots is a mixture of the original surface layer and subsoil material and is somewhat browner and finer textured.

The hazard of erosion is the major limitation for crops. Moderately slow to slow permeability is a limitation for some nonfarm uses. Capability unit IIe–2; woodland suitability group 2w2.

GuC—Guernsey silt loam, 6 to 12 percent slopes. This sloping soil is in the unglaciated uplands. Areas are dissected, irregularly shaped, and slightly to strongly convex. They commonly cover 2 to 10 acres. Slopes are short to medium. This soil is on the same landscape and bedrock formation as Lawshe and Beasley soils. It is downslope from steeper Opequon soils and upslope from alluvial soils or soils on terraces. This soil has the profile described as representative of the series.

Included with this soil in mapping are dark-colored Lawshe soils in slight depressions at the head of drainageways or in narrow bands along drainageways. In areas closest to the steeper Opequon soils or next to Beasley soils, Beasley soils that have some limestone fragments on the surface are included. Some small, severely eroded areas that have a surface layer of yellowish-brown silty clay loam are also included. Some areas contain shallow gullies.

The hazard of erosion is the major limitation for crops. Moderately slow to slow permeability, shallowness to bedrock, a high shrink-swell potential, and slumping are limitations for some nonfarm uses. Capability unit IIIe–2; woodland suitability group 2w2.

GvC3—Guernsey silty clay loam, 6 to 12 percent slopes, severely eroded. This sloping soil is in dissected, irregularly shaped, slightly to strongly convex areas that cover 2 to 10 acres. Slopes are short to medium. This soil is on the same landscape and bedrock formation as Lawshe and Beasley soils. It is downslope from steeper Opequon soils and upslope from alluvial soils or soils on terraces.

This soil has a profile similar to the one described as representative of the series, but its surface layer is mostly subsoil material and is silty clay loam. There are many shallow, crossable gullies and some deeper, uncrossable gullies.

Included with this soil in mapping are Lawshe soils and redder Beasley soils that are slightly eroded and moderately eroded. These soils are in wooded areas and on ridges between gullies.

The hazard of erosion is severe if this soil is cultivated. Moderately slow to slow permeability, shallowness to bedrock, a high shrink-swell potential, and slumping are limitations for many nonfarm uses. Capability unit IVe–3; woodland suitability group 2w2.

GxD3—Guernsey soils, 12 to 18 percent slopes, severely eroded. This strongly sloping soil is in dissected, irregularly shaped, convex areas that range from 3 to 18 acres. It has a profile similar to the one described as representative of the series, but its surface layer is chiefly subsoil material and is mainly silty clay loam. This soil is shallower to bedrock. There are many shallow, crossable gullies and some deeper, uncrossable gullies.

Included with this soil in mapping are small areas of dark-colored Lawshe and Beasley soils.

The hazard of erosion is severe, and this soil is best suited to permanent pasture or woodland. The severe erosion, slumping, slope, and shallowness to bedrock are limitations for nonfarm uses. Capability unit VIe–2; woodland suitability group 2w3.

Haubstadt Series

The Haubstadt series consists of moderately well drained, nearly level to moderately steep soils that formed in loess and the underlying, water-worked material. The Haubstadt soils are on dissected lake plains, valley trains, high stream terraces, and areas of kames and moraines. The native vegetation was hardwood forest in which hickory, oak, and maple were dominant.

In a representative profile in a cultivated area, the surface layer is brown silt loam 6 inches thick. The subsoil extends to a depth of 73 inches. The upper 4 inches is yellowish-brown silt loam. The next 8 inches is yellowish-brown loam that has grayish-brown mottles in the lower part. The next 35 inches is yellowish-brown, very firm and brittle loam that has light grayish-brown mottles in the upper part and gray mottles in the lower part. The next 6 inches is brown clay loam that has gray and strong-brown mottles. The lower 14 inches is brown gravelly clay loam that has yellowish-brown and gray mottles. The substratum, to a depth of 110 inches, is brown and strong-brown gravelly clay loam that has gray mottles.

The available water capacity is medium in Haubstadt soils. Permeability is slow in the fragipan, and surface runoff is slow to medium. The root zone is moderately deep and is medium acid to very strongly acid.

Haubstadt soils are used mainly for corn, wheat, soybeans, and grass-legume mixtures for hay and pasture. A moderate acreage is in pasture and woodland, and a small acreage is idle.

Representative profile of Haubstadt silt loam, 2 to 6 percent slopes, in a cultivated field 1¼ miles north of Marshall, ¾ mile west of the intersection of Blue Ribbon and Chestnut Roads, 266 yards north of Chestnut Road, and 133 yards south of Rocky Fork Lake, in Marshall Township:

Ap—0 to 6 inches, brown (10YR 4/3) silt loam; moderate, medium and coarse, granular structure; friable; many fine and medium roots; very strongly acid; abrupt, smooth boundary.

B1—6 to 10 inches, yellowish-brown (10YR 5/4) silt loam; moderate, fine and medium, subangular blocky structure; friable; many fine roots; strongly acid; clear, wavy boundary.

B2t—10 to 18 inches, yellowish-brown (10YR 5/4) loam; common, fine, distinct, grayish-brown (10YR 5/4) mottles below a depth of 15 inches; moderate, fine and medium, angular and subangular blocky structure; friable; many fine roots; thin very patchy clay films on ped faces; very strongly acid; clear, wavy boundary.

IIBx1—18 to 28 inches, yellowish-brown (10YR 5/4) loam; common, fine and medium, distinct, light brownish-gray (10YR 6/2) mottles; weak, very coarse, prismatic structure parting to weak, coarse, subangular blocky; firm and brittle; few fine roots in vertical cracks; thin, very patchy, brown (10YR 4/3) clay films on horizontal ped faces; thin, very patchy, light-gray (10YR 7/2) silt coatings on vertical ped faces; 10 percent pebbles; very strongly acid; gradual, wavy boundary.

IIBx2—28 to 37 inches, yellowish-brown (10YR 5/4) loam; common, fine and medium, gray (10YR 5/1) mottles; weak, very coarse, prismatic structure parting to weak, coarse, subangular blocky; very firm and brittle; few fine roots in vertical cracks; medium, continuous, dark-brown (7.5YR 4/4) and brown (10YR 5/3) clay films on ped faces; thin, patchy, light-gray (10YR 7/2) silt coatings on vertical and horizontal ped faces; 10 percent pebbles; very strongly acid; gradual, wavy boundary.

IIBx3—37 to 53 inches, yellowish-brown (10YR 5/4) loam; common, medium, distinct, gray (10YR 5/1) mottles and few, medium, distinct, yellowish-brown (10YR 5/8) mottles; moderate, very coarse, prismatic structure parting to weak, medium and coarse, subangular blocky; very firm and brittle; medium, patchy, grayish-brown (10YR 5/2) clay films on vertical ped faces and medium, continuous, brown (10YR 4/3) clay films on vertical and horizontal ped faces; thin, patchy, light-gray (10YR 7/2) silt coatings on vertical and horizontal ped faces; 10 percent pebbles; very strongly acid; gradual, wavy boundary.

IIB31t—53 to 59 inches, brown (10YR 5/3) clay loam; many, medium, distinct, gray (10YR 6/1) mottles and common, medium, distinct, strong-brown (7.5YR 5/6) mottles; moderate, fine and medium, angular blocky structure; firm; thin, continuous, brown (10YR 4/3) clay films on ped faces; 10 percent pebbles; very strongly acid; clear, wavy boundary.

IIB32t—59 to 73 inches, brown (10YR 5/3) gravelly clay loam; many, medium, distinct, yellowish-brown (10YR 5/6) mottles and common, medium, disinct, gray (10YR 6/1) mottles; weak, fine and medium, subangular blocky structure; firm; thin, patchy, brown (10YR 5/3) and light brownish-gray (10YR 6/2) clay films on ped faces; common, medium and coarse, black (10YR 2/1) stains and concretions; 20 percent pebbles; strongly acid; clear, wavy boundary.

IIC—73 to 110 inches, brown (7.5YR 5/4) and strong-brown (7.5YR 5/6) gravelly clay loam; common, medium, prominent, gray (10YR 6/1) mottles; massive; firm; 20 percent pebbles; neutral.

The solum is 60 to 90 inches thick, and the loess cap is 16 to 40 inches thick. Depth to the fragipan is 16 to 36 inches. Reaction in the solum is medium acid to very strongly acid.

The Ap horizon is very dark gray (10YR 4/1), dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), and brown (10YR 4/3 to 5/3). Profiles in undisturbed areas have an A1 horizon that is very dark grayish brown (10YR 3/2), very dark gray (10YR 3/1), or dark gray (10YR 4/1) and is 1 to 4 inches thick.

The B horizon has a hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 through 6. The B2t horizon is silty clay loam, heavy silt loam, or silt loam. The Bx horizon is loam, light silty clay loam, silt loam, and light clay loam. The B3 horizon is clay loam, silty clay loam, gravelly clay loam, or gravelly silty clay loam. Some profiles have clayey stratification below 50 inches. The B2t, Bxt, and B3t horizons have clay films of brown (10YR 4/3 to 5/3), grayish brown (10YR 5/2), and dark brown (7.5YR 4/4). The Bx and B3 horizons have mottles in hues of 2.5Y, 10YR, and 7.5YR, value of 4 through 6, and chroma of 1 through 8.

Haubstadt soils are part of the drainage sequence that includes well-drained Otwell soils and somewhat poorly drained Dubois soils. Haubstadt soils have a thicker solum and fragipan than Sardinia soils and lack the underlying glacial till of Rossmoyne soils. Haubstadt soils have a fragipan as do Nicholson soils, but they lack the underlying limestone bedrock.

HbA—Haubstadt silt loam, 0 to 2 percent slopes. This nearly level soil is in elongated areas between drainageways and in narrow strips at the edge of broad, flat areas. Areas of this soil cover 2 to 30 acres. There has been little or no erosion of the surface layer.

Included with this soil in mapping are spots of nearly level, somewhat poorly drained Dubois soils and areas of gently sloping well-drained Otwell soils.

Because this soil is nearly level and has a silt loam surface layer that is easily tilled, it is well suited to tobacco. Wetness is a moderate hazard. Slow permeability is a limitation for some nonfarm uses. Capability unit IIw–3; woodland suitability group 2o1.

HbB—Haubstadt silt loam, 2 to 6 percent slopes. This gently sloping soil is in broad areas between waterways and on benches below the higher part of the uplands. Some areas of the soil are on side slopes with steeper areas above or below, and, in some places, they surround flat areas of wetter soils. Areas of this soil cover 2 to 60 acres. This soil has the profile described as representative of the series.

Included in mapping are areas of nearly level, somewhat poorly drained, Dubois soils. Also included are moderately eroded areas and steeper areas of well-drained Otwell soils.

The hazard of erosion is moderate if this soil is farmed. The soil is well suited to tobacco. During periods of heavy rainfall, the soil has a temporary perched water table above the slowly permeable fragipan. This fragipan is a limitation to some nonfarm uses. Capability unit IIe-2; woodland suitability group 2o1.

HbC2—Haubstadt silt loam, 6 to 12 percent slopes, moderately eroded. This sloping soil is along waterways and on benches along valley sides. In some places it is on the nose of slopes below the higher part of the uplands. Areas cover 2 to 80 acres. Most of the larger tracts are along streams, and steeper areas are below.

This soil has a profile similar to the one described as representative of the series, but the fragipan is nearer the surface because erosion has removed part of the original surface layer and the available water capacity is less. Tillage has mixed some of the yellowish-brown subsoil with the original surface layer.

Included with this soil in mapping are a few slightly eroded areas. Also included are spots of well-drained Otwell soils and, in some places, areas of Negley soils that lack a fragipan and have sand and gravel in the lower part of the subsoil.

The hazard of erosion is severe. This soil requires more careful management of growing plants than less eroded Haubstadt soils, because it has a lower capacity to absorb and supply water. The slow permeability in the fragipan is a limitation for some nonfarm uses. Capability unit IIIe–2; woodland suitability group 2o1.

HbC3—Haubstadt silt loam, 6 to 12 percent slopes, severely eroded. This sloping soil is in areas along waterways and on benches along valley sides above steeper soils. Areas cover 2 to 10 acres. This soil has a profile similar to the one described as representative of the series, but the fragipan is nearer the surface because erosion has removed most of the original surface layer and the available moisture capacity is less. The present surface layer is mostly material from the upper part of the subsoil, and tilth is poorer than Haubstadt silt loam, 2 to 6 percent slopes.

Included with this soil in mapping are Negley soils that lack a fragipan and have sand and gravel in the lower part of the subsoil. Also included are small areas of well-drained Otwell soils. In some places, generally along waterways, there are small areas of sloping and moderately steep Boston and Bratton soils that have limestone residuum in the lower part of the subsoil.

The hazard of erosion is severe. Slope and slow permeability in the fragipan are severe limitations to some nonfarm uses. Capability unit IVe-2; woodland suitability group 2o1.

HbD2—Haubstadt silt loam, 12 to 18 percent slopes, moderately eroded. This moderately steep soil is along streams and on benches along valley sides. Areas cover 2 to 25 acres. This soil has a profile similar to the one described as representative of the series but, the fragipan is nearer the surface because erosion has removed part of the original surface layer and the available water capacity is less. The plow layer of this soil is a mixture of the original surface layer and the upper part of subsoil.

Included with this soil in mapping are spots of well-drained, sloping to steep Otwell soils and areas of Negley soils that have sand and gravel in the lower part of the subsoil. Areas of Loudon soils that are underlain by limy shale are also included.

The hazard of erosion is severe if the soil is farmed. This soil requires more careful management for farming than less eroded Haubstadt soils, because it has a lower capacity to absorb and supply moisture to plants. Slope and slow permeability are severe limitations to some nonfarm uses. Capability unit IVe–2; woodland suitability group 2r1.

HbD3—Haubstadt silt loam, 12 to 18 percent slopes, severely eroded. This moderately steep soil is along streams and on benches above steeper soils. Areas cover 5 to 15 acres. This soil has a profile similar to the one described as representative of the series, but the fragipan is nearer the surface because erosion has removed nearly all of the original surface layer and the available water capacity is less. The present surface layer is mostly subsoil material that has poor physical properties, and consequently this soil is more difficult to till than less eroded Haubstadt soils.

Included with this soil in mapping are spots of well-drained Otwell soils and, in some places, Negley soils that lack a fragipan and have sand and gravel in the lower part of the subsoil.

The hazard of erosion is severe if this soil is farmed. Slope and the slow permeability in the fragipan are severe limitations for some nonfarm uses. Capability unit VIe–1; woodland suitability group 2r1.

HcB—Haubstadt-Urban land complex, gently sloping. This complex consists of areas where grading and digging have destroyed or covered the original soil. Most areas are used for urban and industrial development. About 35 to 50 percent of these areas consists of fill or borrow material as a result of grading operations, but there are areas of undisturbed Haubstadt soils. These undisturbed areas are in undeveloped lots, the back part of developed lots, playground areas, and small patches of woodland.

The fill areas have about 1 to 3 feet of fill material overlying areas of undisturbed Haubstadt soils. The borrow areas have exposed substratum and subsoil material typical of the Haubstadt soils.

Included with this complex in mapping are some small areas of Dubois soils.

The surface layer of the disturbed areas commonly has a low content of organic matter and is in poor physical condition. It can be tilled only within a narrow range of moisture content. The surface layer tends to become hard when dry.

There is a hazard of erosion, particularly in construction areas that are without plant cover. If the soil is dry, the fragipan in the undisturbed areas of Haubstadt soils is somewhat difficult to excavate. Capability unit and woodland suitability group not assigned.

HcC—Haubstadt-Urban land complex, sloping. This complex is mainly in and near Hillsboro in areas where the profile of the normal Haubstadt soil has been destroyed or covered as a result of grading and digging operations. Most of the acreage is used for urban and industrial development. Thirty-five to fifty percent of the acreage consists of fill or borrow material that results from grading operations, but there are undisturbed areas of Haubstadt soil. These undisturbed areas are in undeveloped lots, the back part of developed lots, and small patches of woodland.

In the fill areas, about 1 to 3 feet of fill material overlies undisturbed Haubstadt soils. In the borrow areas, the exposed subsoil and substratum are typical of Haubstadt soils.

Included with this complex in mapping are small areas of Otwell and Negley soils.

The surface layer of the disturbed soil commonly has a low content of organic matter and poor physical condition. It tends to become hard when dry.

There is a hazard of erosion, particularly in construction areas where the soil is bare. When the soil is dry, the fragipan in the undisturbed Haubstadt soil is somewhat difficult to excavate. Retaining walls are commonly used on the upslope lot lines. Capability unit and woodland suitability group not assigned.

Hennepin Series

The Hennepin series consists of well-drained, moderately steep to very steep soils that formed in glacial till of Wisconsin age. They are on moraines and side slopes of stream valleys. The native vegetation was hardwood forest in which oak, maple, and hickory were dominant.

In a representative profile in an uncultivated area, the surface layer is dark grayish-brown silt loam 4 inches thick. The subsurface layer is yellowish-brown silt loam 3 inches thick. The subsoil, to a depth of 11 inches, is dark yellowish-brown clay loam. The substratum is dark yellowish-brown gravelly clay loam to a depth of 18 inches and is yellowish-brown gravelly loam to a depth of 60 inches.

The available water capacity is low in Hennepin soils. Permeability is moderate, and surface runoff is rapid to very rapid. The root zone is shallow and is slightly acid to moderately alkaline.

Hennepin soils are used mostly for grass-legume mixtures for hay and pasture. A large acreage of the steeper soils is in forest. Some areas of the more eroded, steeper soils are now idle and are reverting to forest.

Representative profile of Hennepin silt loam, in an area of Hennepin-Miamian silt loams, 18 to 35 percent slopes, moderately eroded, in an uncultivated area 1½ miles northwest of New Petersburg on Bectal Road, 2 miles southwest of the intersection of Bectal Road and State

Route 138, and 50 feet north of State Route 138, in Paint Township:

A1—0 to 4 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine and medium, granular structure; very friable; many roots; common tubular pores; 15 percent pebbles; neutral; abrupt, wavy boundary.

A2—4 to 7 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine and medium, subangular blocky structure; friable; common roots; common tubular and vesicular pores; many, medium, faint, dark grayish-brown (10YR 4/2) organic stains; 15 percent pebbles; slightly acid; clear, wavy boundary.

B—7 to 11 inches, dark yellowish-brown (10YR 4/4) clay loam; moderate, fine and medium, subangular blocky structure; firm; common roots; common tubular pores; common, medium and coarse, faint, dark grayish-brown (10YR 4/2) organic stains; 10 percent gravel; mildly alkaline; clear, wavy boundary.

C1—11 to 18 inches, dark yellowish-brown (10YR 4/4) gravelly clay loam; few, fine, faint, yellowish-brown (10YR 5/6) mottles; weak, medium and coarse, subangular blocky structure; firm; few roots; common tubular pores; 25 percent gravel; mildly alkaline, calcareous; gradual, wavy boundary.

C2—18 to 60 inches, yellowish-brown (10YR 5/4) gravelly loam; few, fine, faint, yellowish-brown (10YR 5/6) mottles; massive; firm; few roots; common tubular pores; 25 percent gravel; mildly alkaline, calcareous.

The solum is weakly expressed and is commonly less than 15 inches thick, but it is as much as 20 inches thick in places. Reaction is slightly acid to mildly alkaline in the A horizon and is slightly acid to moderately alkaline in the B horizon.

The A1 horizon is dark grayish-brown (10YR 4/2), brown (10YR 5/3), or yellowish-brown (10YR 5/4). The B horizon is typically loam or clay loam. It is generally 3 to 8 inches thick, but it is as much as 12 inches thick in places. It has moderate, granular or subangular blocky structure. The B and C horizons are mainly dark brown (10YR 4/3), yellowish brown (10YR 5/4), and dark yellowish-brown (10YR 4/4).

Hennepin soils are part of the drainage sequence that includes well drained Miamian soils, moderately well drained Celina soils, somewhat poorly drained Crosby soils, and very poorly drained, dark-colored Brookston soils. Hennepin soils lack the B2t horizon of Miamian and Hickory soils. They are also shallower to calcareous glacial till than Miamian soils. Unlike Hickory soils, they are underlain by glacial till of Wisconsin age.

HeF2—Hennepin-Miamian silt loams, 18 to 35 percent slopes, moderately eroded. These soils are in narrow, irregularly shaped areas on hillsides and in narrow bands or on escarpments along streams and drainageways. Areas range from 5 to 30 acres. The complex is next to and below Miamian soils and Miamian-Russell complexes and is commonly above soils on terraces and flood plains. It is about 70 percent Hennepin soils and 30 percent Miamian and other soils.

One of the Hennepin soils in this complex has the profile described as representative of the Hennepin series. The surface layer of the complex is silt loam in most places, but in some more eroded places, the texture may differ.

Included with these soils in mapping are slightly eroded Hennepin and Miamian soils in wooded areas and a few small areas of severely eroded Hennepin and Miamian soils.

Slope and erosion are severe limitations for farming and for nonfarm uses. This complex should be kept in a permanent cover of grass or trees. Capability unit VIe-1; woodland suitability group 2r1.

HeG2—Hennepin-Miamian silt loams, 35 to 50 percent slopes, moderately eroded. These soils are in narrow, irregularly shaped areas on hillsides and in narrow bands or on escarpments along streams and drainageways. Areas range from 5 to 30 acres. This complex is about 80 percent Hennepin soils and 20 percent Miamian and other soils.

Included with this complex in mapping are slightly eroded Hennepin and Miamian soils and other soils in wooded areas. Also included are severely eroded areas of these soils where the surface layer has a texture more like that of the subsoil or substratum. Small areas of soils that are shallow to limestone bedrock are included in places on the lower part of the slopes.

Slope and erosion are severe limitations for farming and for nonfarm uses. This complex should be kept in a permanent cover of grass or trees, but the very steep slopes limit the use of machinery to manage pasture or woodland. Capability unit VIIe-1; woodland suitability group 2r1.

HfE3—Hennepin-Miamian complex, 12 to 25 percent slopes, severely eroded. These soils are in narrow, irregularly shaped areas on hillsides and in narrow bands or on escarpments along streams and drainageways. Areas range from 5 to 30 acres. The complex is next to and below Miamian soils and Miamian-Russell complexes and is commonly above soils on terraces and flood plains. It is about 70 percent Hennepin soils and 30 percent Miamian and other soils.

This complex is dissected by many shallow gullies. In most places the surface layer has the same texture as the subsoil or substratum layers exposed by severe erosion.

Included with this complex in mapping are small areas of moderately eroded Hennepin-Miamian complexes and other soils. Also included are slightly eroded Hennepin and Miamian and other soils in wooded areas. Small areas of soils that are shallow to limestone bedrock are included in places on the lower part of the slopes.

Slope and erosion are severe limitations for farming and for nonfarm uses. A permanent cover of grass or trees prevents excessive loss of water and soil material. Capability unit VIe-1; woodland suitability group 2r1.

Hickory Series

The Hickory series consists of moderately well drained and well drained, sloping to very steep soils that formed in a thin cap of loess and the underlying glacial till. Hickory soils are most commonly next to streams on the dissected Illinoian till plain. The native vegetation was hardwood forest in which hickory and oak were dominant.

In a representative profile in a cultivated area, the surface layer is dark grayish-brown silt loam that has yellowish-brown mottles and is 6 inches thick. The subsoil extends to a depth of 36 inches. The upper 6 inches is yellowish-brown silty clay loam. The next 9 inches is dark yellowish-brown clay loam. The lower 15 inches is dark yellowish-brown clay loam that has yellowish-brown mottles. The substratum, to a depth of 60 inches, is brown clay loam that has yellowish-brown and gray mottles.

The available water capacity is medium in Hickory soils. Permeability is moderate, and surface runoff is moderately rapid to rapid, depending on slope. The root zone is moderately deep and is commonly medium acid to very strongly acid.

Hickory soils are used mainly for wheat, oats, grass-legume mixtures for hay and silage, corn, and tobacco.

A large acreage of steeper and more eroded Hickory soils is used for pasture and woodland. A small acreage is idle (fig. 5).

Representative profile of Hickory silt loam, 6 to 12 percent slopes, moderately eroded, in a cultivated field 1½ miles northwest of Buford, ½ mile east of the Brown County line, ½ mile south of the intersection of State Route 286 and Beltz Road, and 350 feet east of Beltz Road, in Clay Township:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam; many, medium and coarse, distinct, yellowish-brown (10YR 5/6) mottles; weak, fine and medium, granular structure; friable; many roots; neutral; abrupt, smooth boundary.

IIB21t—6 to 12 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate, fine and medium, subangular blocky structure; firm; common roots; thin, patchy, yellowish-brown (10YR 5/4) clay films on ped faces; black (10YR 2/1) clay films in a few worm holes; few, fine, distinct, black (10YR 2/1) stains and concretions; 5 percent pebbles; strongly acid; clear, wavy boundary.

IIB22t—12 to 21 inches, dark yellowish-brown (10YR 4/4) clay loam; moderate, medium and coarse, subangular, blocky structure; firm; few roots; thin, patchy, yellowish-brown (10YR 5/4) clay films on horizontal ped faces and thick, continuous, yellowish-brown, (10YR 5/4) clay films on vertical ped faces; common, fine and medium, distinct, black (10YR 2/1) stains and concretions; 5 percent pebbles; medium acid; gradual, wavy boundary.

IIB23t—21 to 32 inches, dark yellowish-brown (10YR 4/4) clay loam; common, medium, distinct, yellowish-brown (10YR 5/8) mottles; moderate, fine and medium, subangular blocky structure; firm; few roots; thin, very patchy, yellowish-brown (10YR 5/4) clay films on horizontal ped faces and thick, continuous, yellowish-brown (10YR 5/4) and pale-brown (10YR 6/3) clay films on vertical ped faces; common, medium, distinct, black (10YR 2/1) stains and concretions; 5 percent pebbles; medium acid; clear, wavy boundary.

IIB3—32 to 36 inches, dark yellowish-brown (10YR 4/4) clay loam; common, medium, distinct, yellowish-brown (10YR 5/8) mottles; massive in places parting to weak, coarse, subangular blocky structure; firm, few roots; dark grayish-brown (10YR 4/2) clay films along root and worm channels; few, fine, distinct, black (10YR 2/1) stains and concretions; 8 percent pebbles; neutral; clear, wavy boundary.

IIC—36 to 60 inches, brown (10YR 5/3) clay loam; common, medium, distinct, yellowish-brown (10YR 5/8) and gray (10YR 6/1) mottles; massive; very firm; 10 percent pebbles; mildly alkaline, calcareous.

The thickness of the solum and the depth to calcareous glacial till range from 18 to 45 inches but are commonly 30 to 40 inches. The loess mantle is as much as 10 inches thick in places. Reaction ranges from very strongly acid to medium acid in the upper part of the B2t horizon and from medium acid to mildly alkaline in the lower part of the B2t horizon and in the B3 horizon.

The Ap horizon is dark yellowish brown (10YR 4/4), dark grayish brown (10YR 4/2), or grayish brown (10YR 5/2). Some profiles have A&B and B1 horizons that are commonly yellowish brown (10YR 5/4 and 5/6). The B2t and B3 horizons are dark yellowish brown (10YR 4/4) or yellowish brown (10YR 5/4 and 5/6) and have clay films and mottles in a hue of 10YR, value of 2 through 6, and chroma of 1 through 8. The upper 10 inches of the B2 horizon lacks mottles that have a chroma of 2 or less. The B2t and B3 horizons are silty clay loam, clay loam, or clay.

In Highland County, Hickory soils have a thinner solum and are shallower to carbonates than defined in the range for the Hickory series. This difference, however, does not alter their usefulness and behavior.

Hickory soils are part of the drainage sequence that includes well drained Cincinnati soils, moderately well drained Rossmoyne soils, somewhat poorly drained Avonburg soils, poorly drained Clermont soils, very poorly drained, dark-colored Blanchester and Patton soils. Hickory soils are underlain by

***Figure* 5.—Natural reseeding of eastern redcedar took place after this area of Hickory soils was no longer used for farming.**

glacial till, and Edenton soils are underlain by limestone bedrock. Hickory soils have a more clayey B horizon and are deeper to calcareous glacial till than Hennepin soils. They lack a fragipan and are shallower to calcareous glacial till than Cincinnati soils.

HkC2—Hickory silt loam, 6 to 12 percent slopes, moderately eroded. This sloping soil is in narrow bands along streams and slope breaks. In some places it has short slopes and separates less sloping areas. Areas cover 4 to 30 acres.

This soil has the profile described as representative of the series. Some areas have steep side slopes along waterways. In cultivated areas the surface layer is mixed with yellowish-brown subsoil material. It has a higher content of clay and poorer tilth.

Included with this soil in mapping are gently sloping Cincinnati and Rossmoyne soils that have a fragipan.

The main limitation for farming is erosion. Slope is a limitation for some nonfarm uses. Capability unit IIIe–1; woodland suitability group 2o1.

HkD2—Hickory silt loam, 12 to 18 percent slopes, moderately eroded. This moderately steep soil is along streams and along the lower end of waterways that outlet into streams. In some places it has short slopes and separates less sloping areas. Areas cover 3 to 25 acres. Some areas have steep side slopes along waterways. In cultivated areas the surface layer is mixed with yellowish-brown subsoil material. It has a higher content of clay and poorer tilth.

Included with this soil in mapping are Cincinnati and Rossmoyne soils that have a fragipan and are deeper to glacial till. Also included in some places are soils of the Boston-Bratton complex, Edenton soils underlain by limestone bedrock, Loudon soils underlain by limy shale, and a few limestone outcrops.

Slope and erosion are the main limitations for farming. Slope is a limitation for some nonfarm uses. Capability unit IVe–1; woodland suitability group 2r1.

HkE2—Hickory silt loam, 18 to 25 percent slopes, moderately eroded. This steep soil is along streams and along the lower end of waterways that outlet into streams. In some places the steep slopes are dissected by short waterways. Areas cover 3 to 35 acres. This soil has a profile similar to the one described as representative of the series, but its surface layer is thinner.

Included with this soil in mapping are slightly eroded Hickory soils and moderately eroded, moderately steep Cincinnati soils that have a fragipan and are deeper to glacial till. Also included on the lower part of the slopes are soils of the Boston-Bratton complex, Edenton soils underlain by limestone bedrock, and Loudon soils underlain by limy shale bedrock.

Slope and erosion are severe limitations for farming and for nonfarm uses. Capability unit VIe–1; woodland suitability group 2r1.

HkF2—Hickory silt loam, 25 to 35 percent slopes, moderately eroded. This very steep soil is along streams and along the lower end of waterways that outlet into streams. Areas range from 4 to 50 acres. This soil has a profile similar to the one described as representative of the series, but its surface layer is thinner.

Included with this soil in mapping are small areas of moderately steep and steep Cincinnati soils that have a fragipan and are deeper to glacial till. Also included in some places are areas of Edenton soils that are underlain by shale and limestone bedrock. Where the lower slopes join the flood plain of streams, small areas of alluvial soils are also included.

Slope and erosion are severe limitations for farming and for nonfarm uses. Most areas are in a permanent cover of grass or trees. Capability unit VIe–1; woodland suitability group 2r1.

HyC3—Hickory clay loam, 6 to 12 percent slopes, severely eroded. This sloping soil is in narrow bands along streams and waterways and at the head of waterways. In some places it has short slopes and separates less sloping areas. Areas cover 2 to 25 acres.

This soil has a profile similar to the one described as representative of the series, but erosion has removed much of the surface layer, and the glacial till is nearer the surface. The present surface layer is mostly subsoil material and has very poor tilth. Some areas are dissected by small gullies.

Included with this soil in mapping are gently sloping Cincinnati and Rossmoyne soils that have a fragipan. Also included on the lower part of the slopes are soils of the Boston-Bratton complex that are underlain by limestone bedrock.

Slope and severe erosion are the main limitations for farming and for some nonfarm uses. Capability unit IVe–1; woodland suitability group 2o1.

HyD3—Hickory clay loam, 12 to 18 percent slopes, severely eroded. This moderately steep soil is along streams and along the lower end of waterways that outlet into streams. In some places the soil has short slopes and separates less sloping areas. Areas cover 2 to 40 acres.

This soil has a profile similar to the one described as representative of the series, but its surface layer is thinner, and the glacial till is nearer the surface. The present surface layer is mostly subsoil material; it has very poor tilth because of its high content of clay. Some areas are dissected by gullies.

Included with this soil in mapping are sloping and moderately steep Cincinnati and Rossmoyne soils that have a fragipan and are deeper to glacial till. Also included in some places are soils of the Boston-Bratton complex, Edenton soils underlain by limestone bedrock, and Loudon soils underlain by limy shale bedrock.

Slope and the severe erosion are the main limitations for farming and for some nonfarm uses. Capability unit VIe–1; woodland suitability group 2r1.

HyE3—Hickory clay loam, 18 to 25 percent slopes, severely eroded. This steep soil is along streams and along the lower end of waterways that outlet into streams. In some places the slopes are dissected by short waterways. Areas cover 4 to 25 acres.

This soil has a profile similar to the one described as representative of the series, but its surface layer is thinner, and the glacial till is nearer the surface. Erosion has removed nearly all of the original surface layer, and small stones and pebbles often are commonly on the surface. Many areas dissected by gullies.

Included with this soil in mapping are moderately eroded, moderately steep Cincinnati soils that have a fragipan. Also included on the lower part of the slopes are soils of the Boston-Bratton complex, Edenton soils underlain by limestone bedrock, and Loudon soils underlain by limy shale bedrock.

Slope and the severe erosion are severe limitations for farming and for nonfarm use. Capability unit VIe–1; woodland suitability group 2r1.

Jessup Series

The Jessup series consists of well-drained, moderately steep soils that formed in loess, glacial till, and residuum weathered from shale. The Jessup soils are on dissected uplands in areas of Illinoian glacial till. The native vegetation was hardwood forest in which oak, maple, and beech were dominant.

In a representative profile, the surface layer is brown silt loam 6 inches thick. The subsurface layer is light yellowish-brown silt loam 4 inches thick. The subsoil extends to a depth of 46 inches. The upper 7 inches is yellowish-brown silty clay loam. The next 7 inches is brown silty clay loam. The next 14 inches is yellowish-brown clay that has strong-brown mottles in the upper part and grayish-brown and light olive-brown mottles in the lower part. The lower 8 inches is yellowish-brown silty clay that has light brownish-gray and light olive-brown mottles. The substratum, to a depth of 60 inches, is olive and grayish-brown silty clay.

The available water capacity is medium in Jessup soils. Permeability is slow, and surface runoff is rapid. The root zone is moderately deep and is commonly medium acid to very strongly acid.

Jessup soils are used mostly for pasture, hay, and woodland. A large acreage of eroded Jessup soils is idle and is reverting to woodland.

Representative profile of Jessup silt loam, 12 to 18 percent slopes, in an uncultivated field 1¾ miles south of Hillsboro, 250 yards east of State Route 247, and 330 feet north of Rocky Fork Creek, in Liberty Township:

Ap—0 to 6 inches, brown (10YR 4/3) silt loam; weak, medium and coarse, granular structure; very friable; many roots; medium acid; abrupt, smooth boundary.

A2—6 to 10 inches, light yellowish-brown (10YR 6/4) silt loam; weak, thick, platy structure; friable; many roots; brown (10YR 4/3) and dark grayish-brown (10YR 4/2) organic stains and material in old root channels; medium acid; clear, wavy boundary.

B1—10 to 17 inches, yellowish-brown (10YR 5/4) silty clay loam; weak, medium, subangular blocky structure; friable; common roots; thin, very patchy, pale-brown (10YR 6/3) and light-gray (10YR 7/2) silt coatings on vertical ped faces; 5 percent pebbles; strongly acid; clear, wavy boundary.

IIB21t—17 to 24 inches, brown (7.5YR 5/4) silty clay loam; moderate, medium and fine, subangular blocky structure; firm; few roots; thin, patchy, dark yellowish-brown (10YR 4/4) clay films on ped faces; thin, very patchy, light yellowish-brown (10YR 6/4) and light-gray (10YR 7/2) silt coatings on vertical ped faces; 10 percent pebbles; very strongly acid; clear, wavy boundary.

IIB22t—24 to 32 inches, yellowish-brown (10YR 5/6) clay; common, medium, distinct, strong-brown (7.5YR 5/8) mottles; moderate, medium and coarse, subangular blocky structure parting to moderate, fine and very fine, angular blocky; firm; thin and medium, patchy, brown (10YR 4/3) and yellowish-brown (10YR 5/4) clay films on ped faces; 10 percent pebbles; medium acid; clear, wavy boundary.

IIB23t—32 to 38 inches, yellowish-brown (10YR 5/6) clay; common, medium, distinct, grayish-brown (2.5Y 5/2) mottles and few, fine, distinct, light olive-brown (2.5Y 5/6) mottles; weak, coarse, prismatic structure parting to moderate, fine, angular and subangular blocky; firm; thin, patchy, brown (10YR 4/3) and yellowish-brown (10YR 5/4) clay films on ped faces; common, fine and medium, distinct, black (10YR 2/1) stains and concretions; 15 percent pebbles; medium acid; clear, wavy boundary.

IIIB3t—38 to 46 inches, yellowish-brown (10YR 5/4 and 5/6) silty clay; common, fine and medium, distinct, light brownish-gray (2.5Y 6/2) mottles and few, medium, distinct, light olive-brown (2.5Y 5/6) mottles; weak, coarse, prismatic structure parting to moderate, fine, angular and subangular blocky; firm; thin, very patchy, yellowish-brown (10YR 5/4) clay films on vertical ped faces; common, fine and medium, distinct, black (10YR 2/1) stains and concretions; 5 percent shale fragments; neutral; gradual, wavy boundary.

IIIC—46 to 60 inches, olive (5Y 5/4 and 5/6) and grayish-brown (2.5Y 5/2) silty clay; moderate and strong vertical structure faces and platy shale below a depth of 55 inches; very firm; gray (N 5/0) and light yellowish-brown (2.5Y 6/4) shiny pressure faces; 5 percent shale fragments in upper part and 15 percent below a depth of 55; inches; mildly alkaline, calcareous.

The solum is 30 to 60 inches thick, and the loess cap is 10 to 24 inches thick. The glacial till material is 6 to 38 inches thick. Reaction is medium acid to very strongly acid in the upper part of the B horizon and is neutral in the lower part.

The Ap horizon is dark grayish brown (10YR 4/2) to brown (10YR 5/3). Profiles in undisturbed areas have an A1 horizon, 1 to 3 inches thick, that is very dark grayish brown (10YR 3/2) or dark gray (10YR 4/1). The A2 horizon is yellowish brown (10YR 5/4), light yellowish brown (10YR 6/4), brown (10YR 5/3), or pale brown (10YR 6/3).

The B1 horizon is heavy silt loam or silty clay loam, and the B2t and B3t horizons are heavy silty clay loam, clay loam, or clay. The B1 and IIB2t horizons have a hue of 10YR or 7.5YR, value or 4 or 5, and chroma of 4 through 6.

The B3t and C horizons have a hue of 2.5Y, 5Y, and 10YR, value of 5 through 7, and chroma of 3 through 6, and mottles that have a chroma of 2 or less. The C horizon is silty clay or clay.

Jessup soils are part of the drainage sequence that includes moderately well drained Loudon soils. Jessup soils, unlike Trappist and Muse soils, are underlain by calcareous shale bedrock and formed partly in glacial till. They are deeper to bedrock than Edenton soils. They differ from Miamian soils in having C horizon of shale residual material. Jessup soils lack the fragipan of Cincinnati soils.

JeD—Jessup silt loam, 12 to 18 percent slopes. This moderately steep soil is commonly at or near the base of steeper soils. In some places it is on narrow ridges and benches below the main part of the uplands. Areas are commonly 5 to 60 acres.

Included with this soil in mapping are less well drained Loudon soils. Edenton soils underlain by limestone bedrock are included on the lower part of the slopes, and Lawshe soils that have a darker colored, finer textured surface layer are included on the side slopes.

The hazard of erosion is a severe limitation for farming. Slope and slow permeability in the lower part of the subsoil are severe limitations for many nonfarm uses. Capability unit IVe–3; woodland suitability group 3o2.

Johnsburg Series

The Johnsburg series consists of somewhat poorly drained, gently sloping to sloping soils that formed in loess and the underlying material weathered from sandstone. The Johnsburg soils are on ridgetops in the unglaciated uplands. The native vegetation was hardwood forest.

In a representative profile in a cultivated area, the surface layer is dark grayish-brown silt loam 8 inches

thick. The subsoil extends to a depth of 45 inches. The upper 6 inches is yellowish-brown silt loam. The next 6 inches is yellowish-brown silty clay loam that has mottles of gray and yellowish brown. The next 8 inches is yellowish-brown silty clay loam that has gray and light brownish-gray mottles. The next 8 inches is firm and brittle, yellowish-brown silty clay loam that has light brownish-gray and strong-brown mottles. The lower 9 inches is firm and brittle, light yellowish-brown silty clay loam that has light brownish-gray and strong-brown mottles. The substratum, to a depth of 60 inches, is yellowish-brown, light brownish-gray, and strong-brown clay loam. Sandstone bedrock is at a depth of 60 inches.

The available water capacity is medium in Johnsburg soils. Permeability is very slow, and surface runoff is slow to very slow, depending on slope. These soils have a high water table in winter and spring, and they dry out slowly after rain. The root zone is deep and is commonly very strongly acid to medium acid.

The Johnsburg soils are used for wheat, oats, corn, and grass-legume mixtures for hay and pasture. Some areas are in pasture or woodland, and a small acreage is idle and is reverting to woodland.

Representative profile of Johnsburg silt loam, 2 to 8 percent slopes, in a cultivated field 2¼ miles south-southwest of Carmel, ½ mile south of Millerstown Road, 400 yards east-southeast of farm lane, and 50 feet north of woods on ridgetop of Washburn Hill, in Brush Creek Township:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine and medium, granular structure; very friable; many roots; slightly acid; abrupt, smooth boundary.

B1—8 to 14 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, subangular blocky structure; friable; common roots; dark grayish-brown (10YR 4/2) organic stains in old root channels, in pores, and on some ped faces; medium acid; clear, wavy boundary.

B21t—14 to 20 inches, yellowish-brown (10YR 5/4) silty clay loam; common, medium, distinct, gray (10YR 5/1 and 6/1) mottles and common, fine, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; friable; few roots; thin, very blocky structure; friable; few roots; thin, very patchy, dark yellowish-brown (10YR 4/4) clay films on ped faces; dark grayish-brown (10YR 4/2) organic stains in old root channels; strongly acid; clear, wavy boundary.

B22t—20 to 28 inches, yellowish-brown (10YR 5/6) silty clay loam; many, medium, distinct, gray (10YR 6/1) and light brownish-gray (10YR 6/2) mottles; moderate, fine and medium, subangular blocky structure; firm; few roots; thin, patchy, brown (7.5YR 4/4) clay films on ped faces and thin, continuous, dark-gray (10YR 4/1) clay films on vertical ped faces; thin, very patchy, light-gray (10YR 7/2), dry silt coatings on ped faces; very strongly acid; clear, wavy boundary.

IIBx1—28 to 36 inches, yellowish-brown (10YR 5/4) silty clay loam; common, medium, distinct, light brownish gray (10YR 6/2) mottles and few, fine, distinct, strong-brown (7.5YR 5/6) mottles; weak, very coarse, prismatic structure parting to medium platy and weak, coarse, subangular blocky; firm and brittle; thin, very patchy, dark grayish-brown (10YR 4/2) and dark-gray (10YR 4/1) clay films on horizontal ped faces and thin, patchy, dark grayish-brown (10YR 4/2) and dark-gray (10YR 4/1) clay films on vertical ped faces; thin, patchy, light-gray (10YR 7/2), dry silt coatings on vertical and horizontal ped faces; 8 percent sandstone fragments; very strongly acid; gradual, wavy boundary.

IIBx2—36 to 45 inches, light yellowish-brown (10YR 6/4) silty clay loam; common, medium, distinct, light brownish-gray (10YR 6/2) mottles and few, fine, distinct, strong-brown (7.5YR 5/6) mottles; weak, very coarse, prismatic structure parting to weak, thick, platy and weak, coarse, subangular blocky; firm and brittle; thin, patchy, dark-gray (10YR 4/1) clay films on vertical ped faces; common, fine, distinct, very dark brown (10YR 2/2) stains and concretions; thin, very patchy, light-gray (10YR 7/2), dry silt coatings on vertical and horizontal ped faces; 10 percent sandstone fragments; very strongly acid: gradual, wavy boundary.

IIC—45 to 60 inches, variegated yellowish-brown (10YR 5/4 and 5/6), light brownish-gray (10YR 6/2), and strong-brown (7.5YR 5/6) clay loam; massive; firm; dark-gray (10YR 4/1) clay films along some vertical cracks; 15 percent sandstone fragments; very strongly acid; abrupt, smooth boundary.

IIR—60 inches, fine-grained sandstone bedrock.

The solum is 42 to 60 inches thick, and the loess mantle is 18 to 30 inches thick. Depth to the fragipan is 18 to 34 inches, and depth to sandstone bedrock is 42 to 70 inches. Reaction is very strongly acid or extremely acid in the fragipan and the C horizon.

The Ap horizon is dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), or brown (10YR 4/3 and 5/3). Profiles in undisturbed areas have an A1 horizon that is very dark grayish brown (10YR 3/2) or dark gray (10YR 4/1) and is 1 to 4 inches thick.

The B horizon above the fragipan is commonly yellowish brown (10YR 5/4 and 5/6), but in places is dark yellowish brown (10YR 3/4 and 4/4). It ranges from silt loam to silty clay loam. Clay films are thin and very patchy to thin and continuous.

The fragipan is 15 to 30 inches thick. It is yellowish brown (10YR 5/4) to light yellowish brown (10YR 6/4) and contains common to many mottles of low chroma. It is silty clay loam, loam, or heavy silt loam. Common, thin to medium, patchy clay films are on ped faces.

The C horizon has a hue of 10YR or 7.5YR, value of 3 through 6, and chroma of 2 through 6.

Johnsburg soils are underlain by sandstone residuum and bedrock, but Nicholson soils are underlain by limestone.

JoC—Johnsburg silt loam, 2 to 8 percent slopes. This gently sloping to sloping soil is mostly on narrow to moderately broad ridgetops. Some areas of this soil are somewhat elongated and irregularly shaped, and most are convex. They cover 2 to 20 acres.

Included with this soil in mapping are a few areas of a grayer, somewhat poorly drained soil in slight depressions, at the head of small drainageways, and in narrow bands along drainageways. Also included are sloping to moderately steep Wellston soils on small oval-shaped humps, some small areas of moderately and severely eroded Johnsburg soils, and some soils that have slopes of 8 to 12 percent.

The hazard of erosion is the main limitation for farming, but wetness is a moderate limitation. Measures for controlling erosion and improving drainage are needed for crops. This soil has a moderate to strong fragipan that reduces permeability, prolongs the seasonal high water table, and hinders root penetration. Wetness, very slow permeability, and shallowness to bedrock are limitations for nonfarm uses. Capability unit IIe–2; woodland suitability group 4w1.

Kendallville Series

The Kendallville series consists of well-drained, gently sloping to moderately steep soils that formed in a thin loess cap and the underlying glacial outwash material. The Kendallville soils are on undulating till plains, moraines,

eskers, and kames. The native vegetation was hardwood forest in which hickory, oak, and maple were dominant.

In a representative profile in a cultivated area, the surface layer is brown and dark yellowish-brown silt loam 6 inches thick. The subsoil extends to a depth of 38 inches. The upper 15 inches is dark yellowish-brown clay loam that has yellowish-brown mottles in the lower part. The next 10 inches is yellowish-brown clay loam that has yellowish-brown mottles. The lower 7 inches is yellowish-brown gravelly sandy clay loam that has yellowish-brown mottles. The substratum, to a depth of 60 inches, is yellowish-brown clay loam in the upper part and loam in the lower part.

The available water capacity is medium in Kendallville soils. Permeability is moderately slow, and surface runoff is medium to very rapid, depending on slope. The root zone is moderately deep and is medium acid or strongly acid.

Kendallville soils are used mainly for corn, soybeans, wheat, and grass-legume mixtures for hay and pasture. A small acreage is in permanent pasture and woodland.

Representative profile of Kendallville silt loam, 6 to 12 percent slopes, moderately eroded, in a cultivated field 2 miles west-northwest of New Petersburg, 300 feet east of the intersection of State Route 771 and State Route 138, and 65 yards north of State Route 138, in Paint Township:

Ap—0 to 6 inches, brown (10YR 5/3) and dark yellowish-brown (10YR 3/4) silt loam; moderate, fine, subangular blocky structure; friable; many roots; 10 percent pebbles; medium acid; abrupt, smooth boundary.

IIB21t—6 to 13 inches, dark yellowish-brown (10YR 4/4) clay loam; strong, fine and medium, subangular blocky structure; firm; common roots; thin, patchy, brown (7.5YR 4/4) clay films on ped faces; 10 percent pebbles; medium acid; gradual, wavy boundary.

IIB22t—13 to 31 inches, dark yellowish-brown (10YR 4/4) clay loam; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; moderate, fine and medium, subangular blocky structure; firm; common roots; thin, patchy, brown (7.5YR 4/4) clay films on ped faces; common, fine, distinct, black (10YR 2/1) stains and concretions; 15 percent pebbles; strongly acid; clear, wavy boundary.

IIB23t—21 to 31 inches, yellowish-brown (10YR 5/4) clay loam; common, fine, distinct, yellowish-brown (10YR 5/8) mottles; weak, medium and coarse, subangular blocky structure; friable; few roots; thin, very patchy, brown (7.5YR 4/4) clay films on vertical ped faces; few, fine, distinct, black (10YR 2/1) stains and concretions; 15 percent pebbles; medium acid; clear, wavy boundary.

IIB3—31 to 38 inches, yellowish-brown (10YR 5/4) gravelly sandy clay loam; common, fine, distinct, yellowish-brown (10YR 5/8) mottles; weak, coarse, subangular blocky structure; friable; few, fine, distinct, black (10YR 2/1) stains and concretions; 25 percent pebbles; mildly alkaline; clear, wavy boundary.

IIIC1—38 to 46 inches, yellowish-brown (10YR 5/4) clay loam; massive; friable; 15 percent pebbles; mildly alkaline, calcareous; gradual, wavy boundary.

IIIC2—46 to 60 inches, yellowish-brown (10YR 5/4) loam; massive; friable to firm; 15 percent pebbles; mildly alkaline, calcareous.

The solum is 25 to 40 inches thick. The loess mantle is as much as 18 inches thick in places but is commonly 6 to 12 inches thick. Reaction in the solum is medium acid or slightly acid in the surface layer; it is medium acid or strongly acid in the upper part of the B horizon and ranges to neutral or mildly alkaline in the lower part of the B horizon. The solum contains 10 to 30 percent pebbles.

The Ap horizon is brown (10YR 4/3 and 5/3), yellowish brown (10YR 5/4), or dark grayish brown (10YR 4/2). Profiles in undisturbed areas have an A1 horizon, 2 to 4 inches thick, that is very dark grayish brown (10YR 3/2), very dark brown (10YR 2/2), or very dark gray (10YR 3/1). They also have an A2 horizon, 2 to 6 inches thick, that is grayish brown (10YR 5/2), brown (10YR 4/3 and 5/3), or yellowish brown (10YR 5/4).

The B horizon is yellowish brown (10YR 5/4 and 5/6), dark yellowish brown (10YR 4/4), brown (7.5YR 5/4 and 10YR 5/3), and dark brown (7.5YR 4/4 and 10YR 4/3). It is clay loam, loam, or sandy clay loam and is gravelly in places. Clay films are thin and patchy or very patchy on ped faces. They are brown (7.5YR 4/4), dark yellowish brown (10YR 4/4), or dark brown (10YR 4/3).

The C horizon is calcareous glacial till. It is yellowish brown (10YR 5/4 and 5/6), dark yellowish brown (10YR 4/4), brown (7.5YR 5/4 and 10YR 5/3), and dark brown (7.5YR 4/4 and 10YR 4/3).

Kendallville soils are associated with soils in the Miamian and Russell drainage sequences. Kendallville soils are underlain by loam, and Casco, Fox, and Ockley soils are underlain by sand and gravel. They are yellower than Negley soils, and they formed in glacial outwash of Wisconsin age rather than Illinoian age. Kendallville soils formed in glacial outwash, and Miamian and Russell soils formed in glacial till.

KeB—Kendallville silt loam, 2 to 6 percent slopes. This gently sloping soil is on low ridges and low, rounded humps on uplands and terraces. Areas cover 2 to 40 acres. This soil has a profile similar to the one described as representative of the series, but its surface layer is thicker and it is deeper to glacial till.

Included with this soil in mapping are spots of moderately eroded Kendallville soils and Miamian and Celina soils next to the uplands. Also included are Fox and Ockley soils next to the terraces and small areas of wet soils along waterways and in depressions. In some areas there are spots of less than one-half acre that are more droughty because they contain layers of loose sand and gravel. In a few places along Rattlesnake Creek and its tributaries, limestone bedrock is within 4 feet of the surface.

The main limitation for farming is erosion. The moderately slow permeability of the underlying glacial till is a limitation for nonfarm uses. Capability unit IIe–1; woodland suitability group 2o1.

KeC2—Kendallville silt loam, 6 to 12 percent slopes, moderately eroded. This sloping soil is on ridges and rounded humps on uplands and terraces. Areas cover 2 to 40 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are Miamian soils next to the uplands and Fox and Ockley soils next to the terraces. In a few places along Rattlesnake Creek and its tributaries, limestone bedrock is within 4 feet of the surface. In some areas there are spots of less than one-half acre that are more droughty because they contain layers of loose sand and gravel.

The main limitation for farming is erosion. The moderately slow permeability of the underlying glacial till and slope are limitations for nonfarm uses. Capability unit IIIe–1; woodland suitability group 2o1.

KeD2—Kendallville silt loam, 12 to 18 percent slopes, moderately eroded. This moderately steep soil is on ridges and rounded humps on uplands and terraces. Areas cover 2 to 40 acres.

Included with this soil in mapping are Miamian soils next to the uplands and Fox and Ockley soils next to the terraces. In a few places along Rattlesnake Creek and its tributaries, limestone bedrock is within 4 feet of the surface. In some areas there are spots of less than

one-half acre that are more droughty because they contain layers of loose sand and gravel.

Slope and erosion are severe limitations for farming. Slope is a severe limitation for most nonfarm uses. Capability unit IVe–1; woodland suitability group 2r1.

KfD3—Kendallville clay loam, 12 to 18 percent slopes, severely eroded. This moderately steep soil is on ridges and rounded humps on uplands and terraces. It has a profile similar to the one described as representative of the series, but erosion has removed most of its original silt loam surface layer, and the glacial till is nearer the surface. Small gullies are common, and many glacial pebbles are exposed. The soil is shallow and droughty.

Included with this soil in mapping are Miamian soils on the uplands and Fox and Ockley soils next to the terraces. In a few places along Rattlesnake Creek and its tributaries, limestone bedrock is within 4 feet of the surface.

Slope, erosion, and the lower available water capacity are severe limitations for farming. Slope and the hazard of erosion are severe limitations for most nonfarm uses. Capability unit VIe–1; woodland suitability group 2r1.

Lawshe Series

The Lawshe series consists of moderately well drained, gently sloping to moderately steep soils that formed in clayey material weathered from shale and in calcareous colluvial material. The Lawshe soils are on dissected, unglaciated and Illinoian glaciated uplands. The native vegetation was probably prairie grasses and sedges with scattered trees, such as locust, walnut, hackberry, and redcedar.

In a representative profile in a cultivated area, the surface layer is very dark brown silty clay loam 10 inches thick. The subsurface layer is dark grayish-brown and yellowish-brown silty clay 2 inches thick. The subsoil extends to a depth of 23 inches. The upper 6 inches is yellowish-brown silty clay that has grayish-brown mottles. The lower 5 inches is light yellowish-brown and light brownish-gray silty clay. The substratum, to a depth of 31 inches, is light yellowish-brown and gray silty clay and, to a depth of 44 inches, is greenish-gray silty clay that has light yellowish-brown mottles. Shale bedrock is at a depth of 44 inches.

The available water capacity is medium in Lawshe soils. Permeability is very slow, and surface runoff is medium to rapid. The root zone is moderately deep and is commonly neutral to moderately alkaline.

Representative profile of Lawshe silty clay loam, 6 to 12 percent slopes, moderately eroded, in a cultivated field 7 miles south of Hillsboro on U.S. Route 62, 2 miles south on State Route 136, 2¼ miles east on Shaw Road, Millers Road, to McAffee Road, and 0.3 mile south of the intersection of McAffee Road and Concord Road in Concord Township:

Ap—0 to 10 inches, very dark brown (10YR 2/2) silty clay loam, very dark grayish brown (10YR 3/2) when rubbed; moderate, medium, subangular blocky structure; friable; common roots; 4 percent fragments; mildly alkaline, calcareous; abrupt, smooth boundary.

A&B—10 to 12 inches, dark grayish-brown (10YR 4/2) silty clay loam from the A horizon and yellowish-brown (10YR 5/4) silty clay from the B horizon; moderate, medium, subangular blocky structure; firm; few roots; 4 percent coarse fragments; mildly alkaline, calcareous; abrupt, wavy boundary.

B2—12 to 18 inches, yellowish-brown (10YR 5/6) silty clay; common, medium, prominent, grayish-brown (2.5Y 5/2) mottles; weak, coarse, subangular blocky structure; firm; few roots; dark grayish-brown (10YR 4/2) organic coatings in old root and worm channels; 4 percent fragments; mildly alkaline, calcareous; clear, wavy boundary.

B3—18 to 23 inches, light yellowish-brown (2.5Y 6/4) and light brownish-gray (2.5Y 6/2) silty clay; weak, medium, prismatic structure; firm; few roots; 4 percent fragments; mildly alkaline, calcareous; clear, wavy boundary.

C1—23 to 31 inches, light yellowish-brown (2.5Y 6/4) and gray (5Y 6/1) silty clay; weak, coarse, prismatic structure; firm; few roots; 4 percent shale fragments; mildly alkaline, calcareous; gradual, smooth boundary.

C2—31 to 44 inches, greenish-gray (5G 6/1) silty clay; common, medium, distinct, light yellowish-brown (2.5Y 6/4) mottles; weak, coarse, prismatic structure parting along horizontal platy bedding planes like those of the shale bedrock; firm; few roots; 15 percent shale fragments; mildly alkaline, calcareous; clear, smooth boundary.

R—44 inches, light yellowish-brown (2.5Y 6/4) and greenish-gray (5G 6/1) shale bedrock.

The solum is 20 to 34 inches thick. The depth to shale bedrock ranges from 40 to 60 inches. Reaction ranges from neutral to moderately alkaline throughout the horizon.

The A horizon has a hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 1 or 2. The B2 horizon has a hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 4 and 6. It is silty clay loam, silty clay, or clay. Mottles are within 16 inches of the soil surface. They have a hue of 2.5Y, 5Y, and 10YR, value of 5 and 6, and chroma of 2 or less. The C horizon has a hue of 10YR through 2.5Y, 5Y, 5G, 5GY, 7.5YR, and 10YR, value of 5 and 6, and chroma of 1 to 4.

Lawshe soils are not acid and have a darker colored A horizon than Beasley and Guernsey soils. They are deeper to bedrock than Gasconade soils. Unlike Millsdale soils, the solum of Lawshe soils did not develop in till.

LhB—Lawshe silty clay loam, 2 to 6 percent slopes. This gently sloping soil is on the glaciated and residual uplands. It is in slightly concave areas at the head of drainageways, in narrow bands along minor drainageways, and at the base of steeper soils. Areas are irregularly shaped and elongated. They cover 2 to 16 acres. Slopes are 150 to 400 feet wide and ⅛ to ½ mile long. This soil is downslope from Boston-Bratton complexes and Opequon soils and upslope from glacial till and alluvial soils.

This soil has a profile similar to the one described as representative of the series, but its surface layer is thicker, it is not so well drained, and it is deeper to bedrock.

Included with this soil in mapping are Loudon and Jessup soils in glaciated areas and Guernsey and Beasley soils in unglaciated areas, on slight humps, and in convex areas. Also included are areas next to steeper soils and areas of depressional soils. The soils in these areas have a deposit of lighter colored, siltier soil material 6 to 12 inches thick on the surface and are wetter.

The hazard of erosion on the slopes and wetness in seepage areas are moderate limitations for farming. A seasonal water table, the very slow permeability, and shallowness to soft shale bedrock are limitations for nonfarm uses. Capability unit IIIe-3; woodland suitability group 3c1.

LhC2—Lawshe silty clay loam, 6 to 12 percent slopes, moderately eroded. This sloping soil is on the glaciated and residual uplands. Areas are somewhat irregularly shaped and elongated. Most are 4 to 12 acres, but some are as much as 40 acres. Slopes are mostly convex. They

are 150 to 650 feet wide and as much as one mile long. This soil is downslope from Boston-Bratton complexes and Opequon soils and upslope from glacial till and alluvial soils. It has the profile described as representative of the series.

Included with this soil in mapping are Loudon and Beasley soils in glaciated areas and Guernsey and Beasley soils in unglaciated areas. Also included are spots of slightly eroded and severely eroded Lawshe soils.

Erosion, seepage, and deposition in some places are limitations for farming. The very slow permeability, silty clay loam texture, shallowness to shale bedrock, and slumping are severe limitations for nonfarm uses. Capability unit IVe–6; woodland suitability group 3c1.

LhD2—Lawshe silty clay loam, 12 to 18 percent slopes, moderately eroded. This moderately steep soil is on the glaciated and residual uplands. Areas are somewhat irregularly shaped and elongated. Most areas are 5 to 20 acres, but some are as much as 50 acres. Slopes are mostly convex. They are 150 to 650 feet wide and as much as one mile long. This soil is downslope from Boston-Bratton complexes and Opequon soils and upslope from glacial till and alluvial soils. It has a profile similar to the one described as representative of the series, but its surface layer is thinner.

Included with this soil in mapping are slightly eroded Lawshe soils in wooded areas and spots of severely eroded Lawshe soils.

This soil is not suitable for cultivation because of the erosion and slope. It is used mostly for pasture and woodland. Slope, very slow permeability, silty clay loam texture, shallowness to bedrock, and slumping are severe limitations for nonfarm uses. Capability unit VIe–2; woodland suitability group 3c2.

LlD3—Lawshe silty clay, 12 to 18 percent slopes, severely eroded. This moderately steep soil is on the glaciated and residual uplands. Areas are somewhat irregularly shaped and elongated. Most are 3 to 11 acres, but some are as much as 20 acres. Slopes are mostly convex and are 150 to 650 feet wide. This soil is downslope from Boston-Bratton complexes and Opequon soils and upslope from glacial till and alluvial soils.

This soil has a profile similar to the one described as representative of the series, but its surface layer is mostly subsoil material, and it is shallower to shale bedrock. There are many shallow and deeper, uncrossable gullies.

Included with this soil in mapping are slightly eroded Lawshe soils in wooded areas and moderately eroded Lawshe soils in less disturbed areas. Small areas of Beasley, Jessup, and Loudon soils are also included.

This soil is not suitable for cultivation, but it is suited to permanent vegetation. It is used mostly for pasture or woodland. Some areas are idle. Slope, erosion, and very slow permeability are limitations for nonfarm uses. Capability unit VIe–2; woodland suitability group 3c2.

Loudon Series

The Loudon series consists of moderately well drained, gently sloping to steep soils that formed in loess, glacial till, and underlying material weathered from clay shale. The Loudon soils are on dissected uplands. The native vegetation was hardwood forest in which oak and maple were dominant.

In a representative profile in a cultivated area, the surface layer is dark grayish-brown silt loam 8 inches thick. The subsoil extends to a depth of 58 inches. The upper 4 inches is yellowish-brown silt loam. The next 14 inches is yellowish-brown silty clay loam that has strong-brown mottles throughout and light brownish-gray mottles in the lower part. The next 12 inches is yellowish-brown silty clay that has gray mottles. The lower 20 inches is yellowish-brown and gray silty clay that has strong-brown and reddish-gray mottles. The substratum, to a depth of 70 inches, is reddish-gray silty clay loam that has light greenish-gray mottles and, to a depth of 81 inches, is reddish-gray, yellowish-brown, and light greenish-gray silty clay loam. Shale bedrock is at a depth of 81 inches.

The available water capacity is medium in Loudon soils. Permeability is slow, and surface runoff is medium to rapid. The root zone is moderately deep and is commonly medium acid to very strongly acid.

Loudon soils are used mostly for corn, wheat, soybeans, and tobacco. On the more sloping areas, grass-legume mixtures for hay and pasture are grown extensively (fig. 6). Many of these areas are wooded. A large acreage of severely eroded Loudon soils is idle and is reverting to woodland.

Representative profile of Loudon silt loam, 6 to 12 percent slopes, moderately eroded, in a cultivated field 4 miles west of Hillsboro on U.S. Highway 50, 330 yards south of Hoagland on Mad River Road, and 220 yards west of Mad River Road, in New Market Township:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine and medium, granular structure; friable; many roots; medium acid; abrupt, smooth boundary.

B1—8 to 12 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, subangular blocky structure; friable; common roots; strongly acid; clear, wavy boundary.

B21t—12 to 19 inches, yellowish-brown (10YR 5/4) silty clay loam; common, medium, faint yellowish-brown (10YR 5/6) mottles and few, fine, distinct, strong-brown (7.5YR 5/8) mottles; moderate, fine and medium, subangular blocky structure; friable; few roots; thin, patchy, brown (10YR 4/3) clay films on ped faces; very strongly acid; clear, wavy boundary.

IIB22t—19 to 26 inches, yellowish-brown (10YR 5/4) silty clay loam; common, fine, distinct, light brownish-gray (10YR 6/2) mottles and common, medium, distinct, strong-brown (7.5YR 5/6) mottles; moderate, fine and medium, subangular blocky structure; firm; few roots; thin, continuous, light yellowish-brown (10YR 6/4) clay films on vertical ped faces and thin, patchy, brown (10YR 4/3) clay films on horizontal ped faces; thin, patchy, pale-brown (10YR 6/3) silt coatings on vertical and horizontal ped faces; 8 percent pebbles; very strongly acid; clear, wavy boundary.

IIB23t—26 to 38 inches, yellowish-brown (10YR 5/6) silty clay; common, medium, prominent, gray (10YR 6/1) mottles; weak, coarse, subangular blocky structure; firm; few roots; thin, very patchy, gray (10YR 5/1) clay films on vertical and horizontal ped faces; few, medium, prominent, black (10YR 2/1) stains and concretions; 10 percent pebbles; strongly acid; abrupt, wavy boundary.

IIIB31—38 to 45 inches, yellowish-brown (10YR 5/4) and gray (N 6/0) silty clay; common, medium, distinct, strong-brown (7.5YR 5/6) mottles and few, medium, prominent, gray (10YR 5/1) mottles; weak, coarse, prismatic structure parting to weak, coarse, angular blocky; very firm; few roots along vertical ped faces; mildly alkaline; gradual, smooth boundary.

IIIB32—45 to 58 inches, yellowish-brown (10YR 5/4) and gray (N 6/0) silty clay; common, medium, distinct, strong-brown (7.5YR 5/6) mottles and many, medi-

Figure 6.—**High-quality forage crops are grown on Loudon soils where generally the grazing season is long and the forage yields are high**

um, prominent, gray (10YR 5/1) mottles; weak, coarse, prismatic structure; very firm; few roots along vertical ped faces; moderately alkaline, calcareous; gradual, smooth boundary.

IIIC1—58 to 70 inches, reddish-gray (10YR 5/1) silty clay loam; common, medium, prominent, light greenish-gray (5BG 7/1) mottles; weak, thick, platy structure; very firm; moderately alkaline, calcareous; clear, smooth boundary.

IIIC2—70 to 81 inches, variegated reddish-gray (10YR 5/1), yellowish-brown (10YR 5/4 and 5/8), and light greenish-gray (5BG 7/1) partly weathered silty clay loam shale; moderate, thick, platy (rock) structure; firm; highly fragmental in places, but easily crushed and deformed; moderately alkaline, calcareous; gradual, smooth boundary.

IIIR—81 to 100 inches, variegated reddish-gray (10YR 5/1), yellowish-brown (10YR 5/4 and 5/8), light greenish-gray (5BG 7/2), and gray (N 6/0) partly weathered silty clay loam shale; strong, medium, platy (rock) structure; firm; very highly fragmental in place but easily crushed and deformed; moderately alkaline, calcareous.

The solum is 40 to 60 inches thick, and the loess mantle is 10 to 24 inches thick. Depth to shale bedrock ranges from 4 to more than 10 feet. The B1 horizon is slightly acid to strongly acid, the B2t horizon is strongly acid or very strongly acid, and the B3 and C horizons are neutral to moderately alkaline.

The Ap horizon is dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), or brown (10YR 5/3). The B1 horizon is yellowish brown (10YR 5/4), brown (10YR 5/3), or pale brown (10YR 6/3). The B2t horizon is yellowish brown (10YR 5/4) or brown (10YR 4/3 and 5/3). It is clay, silty clay, silty clay loam, or clay loam. The B3 horizon is neutral or has a hue ranging from 5Y to 7.5Y. The C horizon has a hue of 10YR to 5Y.

Loudon soils are part of the drainage sequence that includes well-drained Jessup soils. Unlike Celina, and Xenia, and Canal soils, they are underlain by calcareous shale bedrock. Unlike Beasley and Guernsey soils, part of their solum formed in glacial till. Loudon soils are deeper to bedrock than Edenton soils, and they lack the fragipan of the Rossmoyne soils.

LoB—Loudon silt loam, 2 to 6 percent slopes. This gently sloping soil is on broad ridgetops, near the base of steeper soils, and on narrow ridges below the main part of the uplands. Areas cover 2 to 50 acres. This soil has a profile similar to the one described as representative of the series, but its surface layer is thicker, it has better tilth, and it is deeper to shale residuum. Its root zone is slightly thicker, and its available water capacity is slightly higher.

Included with this soil in mapping are Rossmoyne soils, which have a fragipan, and Boston-Grayford complexes underlain by limestone bedrock.

The hazard of erosion is the main limitation for farming. Slow permeability, a high shrink-swell potential, and depth to bedrock are limitations for many nonfarm uses. Capability unit IIe–2; woodland suitability group 3c1.

LoB2—Loudon silt loam, 2 to 6 percent slopes, moderately eroded. This gently sloping soil is commonly at or near the base of steeper soils and on narrow ridges below the main part of the uplands. Areas cover 2 to 50 acres.

Included with this soil in mapping are Rossmoyne soils, which have a fragipan, and Boston-Grayford complexes underlain by limestone bedrock.

Erosion is the main limitation for farming. Slow permeability, a high shrink-swell potential, and depth to bedrock are limitations for many nonfarm uses. Capability unit IIe–2; woodland suitability group 3c1.

LoC2—Loudon silt loam, 6 to 12 percent slopes, moderately eroded. This sloping soil is commonly at or

near the base of steeper soils and on narrow ridges below the main part of the uplands. Areas cover 2 to 50 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are Rossmoyne soils, which have a fragipan, and Boston-Bratton complexes underlain by limestone bedrock, and Jessup soils. Lawshe soils are included in some places on long side slopes. These have a finer textured surface layer than Loudon soils. Also included are areas of severely eroded Loudon soils that have small gullies. These areas are identified on the detailed soil map by the symbol for a severely eroded spot.

Erosion is the main limitation for farming. Slow permeability, a high shrink-swell potential, and depth to bedrock are limitations for many nonfarm uses. Capability unit IIIe–2; woodland suitability group 3c1.

LoD2—Loudon silt loam, 12 to 18 percent slopes, moderately eroded. This moderately steep soil is commonly at or near the base of steeper soils, along small waterways, and, in some places, on narrow ridges below the main part of the uplands. Areas range from 2 to more than 60 acres.

Included with this soil in mapping are Jessup soils and Edenton soils underlain by limestone bedrock. Lawshe soils are included in some places on side slopes. These soils have a finer textured surface layer than Loudon soils. Also included are a few small areas of severely eroded Loudon soils that have small gullies.

Erosion and slope are severe limitations for farming. Slow permeability, a high shrink-swell potential, depth to bedrock, and slope are limitations for many nonfarm uses. Capability unit IVe–3; woodland suitability group 3c2.

LpE2—Loudon-Edenton silt loams, 18 to 25 percent slopes, moderately eroded. This steep complex is commonly at or near the base of steeper soils and, in some places, is along flood plains and waterways. Most areas cover 2 to 30 acres. About 50 percent of this complex is Loudon soils, and 25 percent is Edenton soils. In most places the Loudon soils occupy the upper part of the slope, and the Edenton soils are on the lower part.

Included with this soil in mapping are Opequon soils underlain by limestone bedrock. Beasley soils are included in areas of colluvium. Lawshe soils are included in some places on side slopes. These soils have a finer textured surface layer than Loudon and Edenton soils. Also included are a few areas of very steep Loudon soils. Limestone crops out in some areas of the Edenton soils.

Slope, erosion, and slow permeability are severe limitations for farming and for nonfarm uses. Most areas of this complex are in permanent vegetation. Capability unit VIe–2; woodland suitability group 3r1.

Markland Series

The Markland series consists of moderately well drained to well drained, gently sloping to moderately steep soils that formed in loess and underlying lacustrine deposits. The Markland soils are in slack-water and lakebed areas. The native vegetation was hardwood forest in which maple, oak, hickory, and beech were dominant.

In a representative profile in a cultivated area, the surface layer is yellowish-brown silt loam 6 inches thick. The subsoil extends to a depth of 35 inches. The upper 14 inches is yellowish-brown heavy silty clay loam. The lower 15 inches is yellowish-brown silty clay that has mottles in a lighter shade of yellowish brown in the upper part. The substratum extends to a depth of 83 inches. It is silty clay that is dark yellowish brown in the upper part, yellowish brown in the middle part, and dark brown in the lower part and has gray mottles throughout.

The available water capacity is medium in Markland soils. Permeability is slow, and surface runoff is medium to rapid, depending on slope. The root zone is moderately deep and commonly neutral to strongly acid.

Markland soils are used mainly for corn, wheat, soybeans, and grass-legume mixtures for hay and pasture. A considerable acreage of the eroded and more sloping areas is idle and is reverting to woodland.

Representative profile of Markland silt loam, 6 to 12 percent slopes, moderately eroded, in a cultivated field, 2⅛ miles east of Marshall, ¾ mile south of State Route 506, and 165 yards east-northeast of Slate Hill Road, in Brush Creek Township:

Ap—0 to 6 inches, brown (10YR 5/3) and yellowish-brown (10YR 5/6) silt loam; weak, medium, subangular blocky structure; friable; common roots; common tubular pores; medium acid; abrupt, smooth boundary.

IIB21t—6 to 20 inches, yellowish-brown (10YR 5/4) silty clay loam; weak, coarse, subangular blocky structure parting to moderate, very fine, angular blocky; firm; few roots; common tubular pores and common vesicular pores; medium, continuous, dark yellowish-brown (10YR 4/4) clay films on vertical and horizontal, somewhat irregular, rounded ped faces; thin, very patchy, pale-brown (10YR 6/3) silt coatings on vertical ped faces; strongly acid; clear, wavy boundary.

IIB22t—20 to 26 inches, yellowish-brown (10YR 5/4) silty clay; common, fine, faint, yellowish-brown (10YR 5/6) mottles; weak, coarse, subangular blocky structure parting to moderate, very fine, angular blocky; very firm; few roots; common tubular pores; medium, patchy, dark yellowish-brown (10YR 4/4) and light brownish-gray (10YR 6/2) clay films on vertical, somewhat irregular, rounded ped faces; many, medium, distinct, black (10YR 2/1) stains; neutral; clear, wavy boundary.

IIB23t—26 to 35 inches, yellowish-brown (10YR 5/4) silty clay; weak, coarse, subangular blocky structure parting to moderate, fine, angular blocky; very firm; common tubular pores; medium, patchy, brown (10YR 5/3) and light brownish-gray (10YR 6/2) clay films on vertical, somewhat irregular, rounded ped faces and medium, patchy, brown (10YR 5/3) clay films on horizontal, somewhat irregular, rounded ped faces; common, medium, distinct, black (10YR 2/1) stains; neutral; clear, wavy boundary.

IIC1—35 to 49 inches, dark yellowish-brown (10YR 4/4) silty clay; common, medium, prominent, gray (5YR 5/1) mottles; weak, medium, prismatic structure parting to weak, medium, angular blocky; firm; few, tubular pores; few, medium, distinct, very pale brown (10YR 8/3) stains and concretions of secondary lime nodules; mildly alkaline, calcareous; clear, wavy boundary.

IIC2—49 to 61 inches, yellowish-brown (10YR 5/4) silty clay; common, medium, prominent, gray (10YR 5/1) mottles; weak, coarse, prismatic structure parting to weak, medium, angular blocky; firm; few, tubular pores; common, medium, distinct, very pale brown (10YR 8/3) stains and concretions of secondary lime nodules; few, medium, distinct, very dark grayish-brown (10YR 3/2) stains; 5 percent pebbles, mildly alkaline, calcareous; gradual, wavy boundary.

IIC3—61 to 83 inches, dark-brown (7.5YR 4/4) silty clay; common, medium, prominent, gray (5YR 5/1) mottles; weak, coarse, prismatic structure; firm; few, tubular pores; many, medium, distinct, very pale

brown (10YR 8/3) stains and concretions of secondary lime nodules; few, medium, distinct, very dark grayish-brown (10YR 3/2) stains; 15 percent pebbles; mildly alkaline, calcareous.

The solum is 20 to 44 inches thick. The loess mantle is commonly 4 to 10 inches thick, but it ranges from 0 to 12 inches. The B2t horizon ranges from neutral to strongly acid.

The Ap horizon is dark grayish brown (10YR 4/2), brown (10YR 5/3) and yellowish brown (10YR 5/6). In unplowed areas the A1 horizon is dark grayish brown (10YR 4/2).

Some profiles have B&A, B1, and B1t horizons that are brown (10YR 5/3) and yellowish brown (10YR 5/4 and 5/6). The B2t horizon is dark brown (10YR 4/3) or yellowish brown (10YR 5/4 and 5/6), and in some profiles the lower part of this horizon has mottles that have chroma of 2 or less. The B2t horizon is heavy silty clay loam, silty clay, and clay. Few to many calcareous nodules are in the lower part of the B horizon and in the C horizon in some profiles.

The C horizon has a hue of 10YR, 7.5YR, or 2.5Y, a value of 4 or 5, and a chroma of 4.

Markland soils are part of the drainage sequence that includes somewhat poorly drained McGary soils and dark-colored, very poorly drained Montgomery soils. Markland soils have a more clayey solum than Celina soils, and they have a C horizon of lake-laid silt and clay. They differ from Milton soils in being underlain by lacustrine material rather than limestone bedrock.

MdB—Markland silt loam, 2 to 6 percent slopes. This gently sloping soil is on slack-water terraces, in lakebed areas, and along drainageways. On the terraces the areas are narrow to broad, but along the drainageways they are short and irregularly shaped. They cover 3 to 10 acres. Slopes are slightly convex.

Included with this soil in mapping are a few areas of McGary and Montogomery soils at the head of and along drainageways. Some areas of moderately eroded Markland soils are also included.

Erosion and slow permeability are limitations if this soil is used for crops. Slow permeability and a high shrink-swell potential are limitations to nonfarm uses. Capability unit IIIe–3; woodland suitability group 2o1.

MdC2—Markland silt loam, 6 to 12 percent slopes, moderately eroded. This sloping soil is in narrow, irregularly shaped areas along streams and drainageways. Areas of this soil cover 2 to 15 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few areas of McGary soils at the head of drainageways and in narrow strips along drainageways. Also included are areas that are slightly eroded and spots of severely eroded Markland soils where there are a few, small, shallow gullies.

Erosion is a severe limitation to the use of this soil for cultivated crops. Slow permeability, slope, and a high shrink-swell potential are limitations to nonfarm uses. Capability unit IVe–3; woodland suitability group 2o1.

MdD2—Markland silt loam, 12 to 18 percent slopes, moderately eroded. This moderately steep soil is along streams and drainageways. Areas of this soil are narrow and irregularly shaped. They cover 2 to 15 acres. This soil has a profile similar to the one described as representative of the series, but the present surface layer is somewhat finer textured and more yellowish brown, because it is a mixture of the original surface layer and part of the subsoil. The substratum is closer to the surface.

Included with this soil in mapping are a few areas of McGary soils in narrow strips along the drainageways. Also included are some areas of severely eroded Markland soils, slightly eroded Markland soils in woodlands, and steeper Markland soils.

Slope and severe erosion are severe limitations to use for cultivated crops. This soil is suited to permanent vegetation. Slope, high shrink-swell potential, and slumping are severe limitations to many nonfarm uses. Capability unit VIe–1; woodland suitability group 2r1.

McGary Series

The McGary series consists of somewhat poorly drained, nearly level to gently sloping soils that formed in loess and the underlying lacustrine deposits. These soils are in slack-water and lakebed areas. The native vegetation was hardwood forest.

In a representative profile in a cultivated area, the surface layer is dark grayish-brown silt loam 8 inches thick. The subsoil extends to a depth of 40 inches. The upper 7 inches of it is light yellowish-brown silty clay loam that has grayish-brown mottles. The next 9 inches is yellowish-brown silty clay that has grayish-brown mottles. The lower 8 inches is gray silty clay that has yellowish-brown, strong-brown, and dark yellowish-brown mottles. The substratum extends to a depth of 60 inches. It is gray silty clay that has yellowish-brown mottles in the upper part and gray clay that has yellowish-brown mottles in the lower part.

The available water capacity is medium in McGary soils. Permeability is very slow to slow, and surface runoff is slow. These soils have a high water table in winter and spring, and they dry out slowly after rain. The root zone is moderately deep to deep, and it is commonly neutral to strongly acid.

McGary soils are used mainly for corn, soybeans, wheat, and grass-legume mixture for hay and pasture. A small acreage is in woodland or is idle.

Representative profile of McGary silt loam, 0 to 4 percent slopes, in a cultivated field, 3½ miles south-southeast of Carmel, ⅝ mile north of the intersection of State Routes 753 and 41 and Couch Road, and 75 yards east of State Route 41, in Bush Creek Township:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; friable; many roots; neutral; abrupt, smooth boundary.

B1tg—8 to 15 inches, light yellowish-brown (10YR 6/4) silty clay loam; common, medium, distinct, grayish-brown (10YR 5/2) mottles; moderate, medium, subangular blocky structure; firm; common roots; thin, patchy, gray (10YR 5/1) and yellowish-brown (10YR 5/4) clay films on ped faces; thin, patchy, light-gray (10YR 6/1) silt coatings on ped faces; medium acid; clear, wavy boundary.

IIB21tg—15 to 24 inches, yellowish-brown (10YR 5/4) silty clay; common, medium, distinct, grayish-brown (10YR 5/2) mottles; moderate, medium, prismatic structure parting to moderate, fine and medium, subangular and angular blocky; very firm; common roots; thin, patchy, gray (10YR 5/1) clay films on ped faces; thin, very patchy, light-gray (10YR 6/1) silt coatings on ped faces; few, fine, distinct, black (10YR 2/1) stains and concretions; medium acid; clear, wavy boundary.

IIB22tg—24 to 32 inches, gray (10YR 5/1) silty clay; many, medium, distinct, yellowish-brown (10YR 5/4) mottles and few, fine, distinct, strong-brown (7.5YR 5/6) mottles; moderate, medium, prismatic structure parting to moderate, fine and medium, subangular and angular blocky; very firm; few roots; thin, patchy, dark-gray (N 4/0) clay films on ped faces; common, fine, distinct, black (10YR 2/1) stains and concretions; medium acid; gradual, wavy boundary.

IIB3tg—32 to 40 inches, gray (10YR 5/1) silty clay; many, fine, distinct, strong-brown (7.5YR 5/6) mottles and few, fine distinct, dark yellowish-brown (10YR 4/4) mottles; moderate, medium, prismatic structure parting to moderate, fine and medium, subangular and angular blocky; firm; thin, patchy, dark-gray (N 4/0) clay films on ped faces; neutral; gradual, irregular boundary.

IIC1—40 to 47 inches, gray (10YR 6/1) silty clay; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, fine, subangular and angular blocky structure; firm; mildly alkaline, calcareous; gradual, wavy boundary.

IIC2—47 to 60 inches, gray (10YR 6/1) clay; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, thick, platy structure; firm; mildly alkaline, calcareous.

The solum is 24 to 60 inches thick, but it commonly is 30 to 48 inches thick. The loess mantle is 6 to 24 inches thick, but it is commonly 14 to 20 inches thick. Mottles that have a chroma of 2 or less occur below the Ap horizon.

The Ap horizon is dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), or dark brown (10YR 4/3).

The B horizon is silty clay loam to clay. It ranges from grayish brown (10YR 5/2), brown (10YR 5/3), and yellowish brown (10YR 5/4) in the upper part to gray (10YR 5/1) and grayish brown (10YR 5/2) in the lower part, but in places the lower part has a hue of 7.5YR or 2.5Y. Throughout this horizon are mottles that have a hue of 10YR and 7.5YR, a value of 4 and 5, and a chroma of 2 through 6.

The C horizon has a hue of 10YR, 7.5YR, and 2.5Y.

McGary soils are part of the drainage sequence that includes moderately well drained to well drained Markland soils and very poorly drained, dark-colored Montgomery soils. McGary soils have a finer textured B horizon than Crosby soils and are underlain by lacustrine deposits. They have finer textured B and C horizons than Fitchville soils. McGary soils are underlain by calcareous lacustrine deposits, but Sleeth soils are underlain by calcareous sand and gravel.

MgB—McGary silt loam, 0 to 4 percent slopes. This nearly level to gently sloping soil is on narrow to broad slack-water terraces, in lakebed areas, and in short, irregularly shaped areas at the head of and along drainageways. Areas of this soil cover 3 to 15 acres. Slopes are slightly convex.

Included with this soil in mapping are Montgomery soils at the head of and in narrow strips in drainageways. Also included are some areas of moderately eroded McGary and Markland soils that have a slope of 4 to 6 percent.

Wetness in the nearly level areas and wetness and erosion in gently sloping areas are moderate limitations to farm use. Wetness, slow to very slow permeability, and a seasonal high water table are limitations to some nonfarm uses. Capability unit IIIw-2; woodland suitability group 3w1.

Miamian Series

The Miamian series consists of well-drained, gently sloping to steep soils that formed in thin loess and underlying glacial till. The Miamian soils are on glacial till uplands, mostly in areas of end moraines and dissected till plains. The native vegetation was hardwood forest in which maple, beech, oak, and hickory were dominant.

In a representative profile in a cultivated area, the surface layer is dark grayish-brown silt loam 7 inches thick. The subsoil extends to a depth of 30 inches. The upper 10 inches of the subsoil is yellowish-brown silty clay loam that is mottled in the lower part. The next 8 inches is mottled, yellowish-brown clay. The lower 5 inches is mottled, yellowish-brown clay loam. The substratum is yellowish-brown clay loam to a depth of 36 inches and yellowish-brown loam that is firm and compact to a depth of 60 inches.

The available water capacity is medium in Miamian soils. Permeability is moderately slow, and surface runoff is medium to rapid, depending on slope. The root zone is moderately deep and is neutral to strongly acid.

Miamian soils are used mainly for farm crops. The main crops are corn, soybeans, wheat, and grass-legume mixtures for hay and pasture. Much of the acreage of the steeper Miamian soils is in permanent pasture or is wooded.

Representative profile of Miamian silt loam, 2 to 6 percent slopes, in a cultivated field 2½ miles west of Highland on State Route 28, 1 mile on McVey Road, 400 feet southeast of Clinton County line, and 75 feet south of McVey Road, in Fairfield Township:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine and medium, granular structure; friable; many roots; neutral; abrupt, smooth boundary.

B1t—7 to 11 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate, fine and medium, subangular blocky structure; firm; common roots; thin, very patchy, brown (7.5YR 4/4) clay films on ped faces; 4 percent pebbles; slightly acid; clear, smooth boundary.

IIB21t—11 to 17 inches, yellowish-brown (10YR 5/4) silty clay loam; few, fine, faint, yellowish-brown (10YR 5/6) mottles; strong, medium, subangular and angular blocky structure; firm; common roots; medium, very patchy, dark-brown (10YR 4/3) clay films on ped faces; medium, very patchy, light yellowish-brown (10YR 6/4) silt coatings on ped faces; few, medium, prominent, black (10YR 2/1) stains and concretions; 5 percent pebbles; medium acid; clear, wavy boundary.

IIB22t—17 to 25 inches, yellowish-brown (10YR 5/4) clay; few, medium, faint, yellowish-brown (10YR 5/6) mottles; strong, medium, subangular and angular blocky structure; firm; few roots; medium, very patchy, dark-brown (10YR 4/3) clay films on horizontal ped faces and medium, continuous, dark-brown (10YR 4/3) clay films on vertical ped faces; few, medium, prominent, black (10YR 2/1) stains and concretions; 5 percent pebbles; medium acid; gradual, wavy boundary.

IIB3t—25 to 30 inches, yellowish-brown (10YR 5/4) clay loam; few, medium, faint, yellowish-brown (10YR 5/6) mottles; weak, coarse, subangular blocky structure; firm; few roots; thin, very patchy, dark-brown (10YR 4/3) clay films on vertical ped faces; common, fine, prominent, very dark brown (10YR 2/2) stains and concretions; 8 percent pebbles; neutral; clear, wavy boundary.

IIC1—30 to 36 inches, yellowish-brown (10YR 5/4) clay loam; massive; firm; 10 percent pebbles; mildly alkaline, calcareous; gradual, wavy boundary.

IIC2—36 to 60 inches, yellowish-brown (10YR 5/4) loam; massive; firm and compact; 10 percent pebbles; mildly alkaline, calcareous.

The solum is 20 to 40 inches thick, and the loess mantle is 0 to 18 inches thick. Reaction ranges from strongly acid to neutral in the upper part of the solum and from slightly acid to mildly alkaline in the lower part. Pebbles make up 5 to 15 percent of the volume below the loess mantle.

The Ap horizon is dark grayish brown (10YR 4/2) and brown (10YR 4/3 and 5/3). Profiles in undisturbed areas have an A1 horizon, 1 to 4 inches thick, that is very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2).

The B1t and B2t horizons have hues of 10YR and 7.5YR, values of 4 and 5, and chroma of 4. The lower part of the B2t horizon ranges to reddish brown (5YR 4/3 and 4/4) in some places. Thin to medium, very patchy to continuous clay films are dark yellowish-brown (10YR 4/4), dark brown (10YR 4/3

and 7.5YR 3/2), and brown (7.5YR 5/4 and 4/4). The B1t and B2t horizons range from silty clay loam to clay.

The C horizon is commonly yellowish brown (10YR 5/4) or brown (10YR 4/3).

Miamian soils are part of the drainage sequence that includes well drained Hennepin soils, moderately well drained Celina soils, somewhat poorly drained Crosby soils, and very poorly drained, dark-colored Brookston soils. Miamian soils have a thinner loess mantle, have a higher clay content in the B horizon, and are shallower to calcareous glacial till than Russell soils. They are underlain by glacial till, and Milton soils are underlain by limestone bedrock at a depth of less than 40 inches. Miamian soils have a thicker solum than Hennepin soils and do not have the gravelly B horizon that is characteristic of Kendallville soils.

MlB—Miamian silt loam, 2 to 6 percent slopes. This gently sloping soil is in broad, convex areas and on ridges in the uplands. Areas of this soil vary widely in length and width. They commonly cover 3 to 15 acres, but some areas are as large as 70 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of moderately eroded Miamian soils and areas of Crosby and Brookston soils at the head of and along drainageways. These soils are wetter than the Miamian soil.

The hazard of erosion is moderate, and some measures for controlling erosion are necessary if this soil is cultivated. Moderately slow permeability is the main limitation for some nonfarm uses. Capability unit IIe-1; woodland suitability group 2o1.

MlB2—Miamian silt loam, 2 to 6 percent slopes, moderately eroded. This gently sloping soil is in broad, convex areas and on ridges in the uplands. Areas of this soil vary widely in width and length. Most range from 3 to 15 acres, but a few areas are larger. This soil has a profile similar to the one described as representative of the series, but part of the original surface layer has been removed by erosion. The present plow layer includes subsoil material, is finer textured, and is browner. As a result, this soil has poorer tilth and a lower available water capacity.

Included with this soil in mapping are wetter Crosby and Brookston soils at the head of and along drainageways. Also included are some small areas of slightly eroded Miamian soils.

The texture of the surface layer makes this soil somewhat difficult to till. The hazard of erosion is moderate, and some measures for controlling erosion are necessary if the soil is cultivated. Moderately slow permeability is the main limitation for many nonfarm uses. Capability unit IIe-1; woodland suitability group 2o1.

MlC2—Miamian silt loam, 6 to 12 percent slopes, moderately eroded. This sloping soil is in irregularly shaped, elongated areas that are dissected by drainageways and, in many places, are adjacent to flood plains and steeper soils. It has a profile similar to the one described as representative of the series, but part of the original surface layer has been removed by erosion, and the present plow layer includes subsoil material, is finer textured, and is browner.

Included with this soil in mapping are areas of uneroded Miamian soils that are wooded and small to medium-sized areas of severely eroded Miamian soils.

Slope and the hazard of erosion are limitations for both farm and nonfarm uses. Capability unit IIIe–1; woodland suitability group 2o1.

MlD2—Miamian silt loam, 12 to 18 percent slopes, moderately eroded. This moderately steep soil is generally in long, irregularly shaped areas on hillsides and in narrow bands on the sides of valleys that parallel streams and drainageways. It is also in small irregularly shaped areas on the till plain. The areas range from 2 to 40 acres but are generally 6 to 15 acres. This soil has a profile similar to the one described as representative of the series, but part of the original plow layer has been removed by erosion, and the present plow layer includes subsoil material, is finer textured, and is browner.

Included with this soil in mapping are areas of uneroded Miamian soils that are wooded. Also included are severely eroded Hennepin and Miamian soils, particularly on the steeper slopes.

This soil has limited suitability for cultivated crops. It is suited to permanent pasture and woodland. Slope and a severe hazard of erosion are limitations for farm and nonfarm uses. Capability unit IVe–1; woodland suitability group 2r1.

MlE—Miamian silt loam, 18 to 25 percent slopes. This steep soil is generally in irregularly shaped, elongated areas on hillsides and in narrow bands along streams and drainageways. The areas cover 3 to 17 acres.

Included with this soil in mapping are less sloping Miamian soils and moderately eroded and severely eroded Hennepin and Miamian soils. Also included in the lower part of the areas of this soil are soils that are shallow to limestone bedrock.

This soil is not suited to cultivated crops, but it is suited to permanent vegetation. Most areas are wooded. Slope and a severe hazard of erosion are severe limitations for farm and nonfarm uses. Capability unit VIe-1; woodland suitability group 2r1.

MmC3—Miamian clay loam, 6 to 12 percent slopes, severely eroded. This sloping soil is in irregularly shaped, elongated areas that are parallel to drainageways and streams on the glacial till plain. The areas range in size from 3 to 50 acres, but most are 5 to 25 acres. They are generally bordered by less eroded Miamian soils and steeper Hennepin and Miamian soils.

This soil has a profile similar to the one described as representative of the series, but the surface layer has a high content of clay and consists mostly of subsoil material. Small, shallow gullies are numerous in areas of this soil, and limy, coarser textured glacial till is commonly exposed at the surface.

Included with this soil in mapping are medium to small areas of moderately eroded Miamian soils. Also included are small areas of steeper and shallower Miamian and Hennepin soils.

This soil is difficult to till. Slope and a severe hazard of erosion are limitations for farm and nonfarm uses. Capability unit IVe-1; woodland suitability group 2o1.

MrB—Miamian-Russell silt loams, 2 to 6 percent slopes. This mapping unit is about 50 percent Miamian soils and 50 percent Russell and other soils. These gently sloping soils occupy broad, convex areas along minor drainageways and narrow, elongated ridges in the uplands. The areas of this mapping unit vary widely in length and width and range from 3 to 50 acres in size. Slopes are long to short.

Included with these soils in mapping are wetter Crosby, Fincastle, and dark-colored Brookston soils that are at the head of and along small drainageways. Also included are small areas of moderately eroded Miamian and Russell soils. Some domelike areas have limestone bedrock within 3 to 5 feet of the surface.

The hazard of erosion is moderate, and some measures for controlling erosion are needed if these soils are cultivated. Moderately slow permeability is the main limitation for nonfarm uses. Capability unit IIe-1; woodland suitability group 2o1.

MrB2—Miamian-Russell silt loams, 2 to 6 percent slopes, moderately eroded. This mapping unit is about 60 percent Miamian soils and 40 percent Russell and other soils. These gently sloping soils are mainly along minor drainageways but also occupy broad, convex areas and narrow ridges in the uplands. The areas vary widely in width and length and range from 3 to 30 acres in size. Slopes are long to short.

Profiles of these soils differ from the profiles described as representative of the Miamian and Russell series in that the surface layer is thinner, finer textured, and browner. As a result, tilth is poorer and the available water capacity is lower, especially in the Miamian soils.

Included with these soils in mapping are Crosby, Fincastle, and dark-colored Brookston soils that are at the head of and along small drainageways. These soils are wetter than the Miamian and Russell soils. Also included are small areas of severely eroded Miamian soils that have a surface layer which consists primarily of subsoil material. Many small, shallow gullies are in these areas. Small, slightly eroded areas dominantly of Russell soils are also included. Some domelike areas have limestone bedrock at a depth of 3 to 5 feet.

The hazard of erosion is moderate, and measures for controlling erosion are needed if these soils are cultivated. Moderately slow permeability is the main limitation for nonfarm uses. Capability unit IIe-1; woodland suitability group 2o1.

MrC2—Miamian-Russell silt loams, 6 to 12 percent slopes, moderately eroded. This mapping unit is about 65 percent Miamian soils and 35 percent Russell and other soils. These sloping soils are in irregularly shaped areas, 5 to 40 acres in size, along drainageways. They have short slopes. They are between Celina and Xenia soils at a higher elevation and Brookston soils or soils on flood plains at the base of slopes along drainageways. These soils have profiles similar to the ones described as representative of the Miamian and Russell series, but the surface layer is thinner, finer textured, and browner.

Included with these soils in mapping are small to medium-sized, severely eroded areas dominantly of Miamian soils. In these areas the surface layer consists mainly of subsoil material, and there are many shallow gullies. Also included are a few slightly eroded areas dominantly of Russell silt loam.

Slope and the hazard of erosion are limitations for farming, and slope and moderately slow permeability are limitations for some nonfarm uses. Capability unit IIIe–1; woodland suitability group 2o1.

MsB—Miamian-Urban land complex, gently sloping. Urban land makes up 30 to 50 percent of this complex, and Miamian soils the rest. The complex is mostly in and near the city of Greenfield and is used for urban and industrial development. The Miamian soils in areas of Urban land have been altered by cut and fill operations so that the original soil profile cannot be recognized. The unaltered Miamian soils are in such places as undeveloped areas, playgrounds, and small wooded tracts.

Included in mapping are some areas of Celina and Crosby soils in the undisturbed areas.

The altered soil material in this complex has poor physical condition. The content of organic matter and the available water capacity are reduced. The surface layer has a higher content of clay, which causes the tilth to be poor and increases the tendency of the soil material to harden upon drying. These unfavorable conditions for vegetation and the hazard of erosion are limitations of this complex. Capability unit and woodland suitability group not assigned.

Millsdale Series

The Millsdale series consists of dark-colored, very poorly drained, nearly level soils that formed in glacial till or overwash that is mantled with loess as much as 15 inches thick. These are on uplands where the glacial till is shallow to underlying limestone bedrock. The native vegetation was hardwood forest in which soft maple, ash, elm, and pin oak were dominant.

In a representative profile in a cultivated area, the surface layer is black silty clay loam 13 inches thick. The subsoil extends to a depth of 30 inches. The upper 5 inches of it is very dark brown silty clay. The lower 12 inches is dark-gray clay that has yellowish-brown mottles. The substratum extends to a depth of 32 inches. It is light yellowish-brown sandy clay loam that has grayish-brown mottles. Below a depth of 32 inches is limestone bedrock.

The available water capacity is high in Millsdale soils. Permeability is moderately slow, and the surface runoff is very slow to ponded. These soils have a high water table during winter and spring, and they dry out slowly after rain. The root zone is moderately deep, and it is commonly slightly acid to mildly alkaline. The surface layer has a high content of organic matter.

Millsdale soils are used chiefly for corn, soybeans, wheat, and grass mixtures for hay and pasture. A small acreage is in permanent pasture and woodland.

Representative profile of Millsdale silty clay loam, in a cultivated field, 1½ miles north of Greenfield, 350 yards east of State Route 753, and 200 yards west of Paint Creek, in Madison Township:

Ap—0 to 7 inches, black (10YR 2/1) silty clay loam; moderate, fine and medium, granular structure; friable; many roots; neutral; abrupt, smooth boundary.

A12—7 to 13 inches, black (10YR 2/1) silty clay loam; strong, medium and fine, angular and subangular blocky structure; friable; common roots; neutral; clear, wavy boundary.

IIB21t—13 to 18 inches, very dark brown (10YR 2/2) silty clay; moderate, medium, prismatic structure parting to strong, medium, subangular blocky; firm; few roots; thin, patchy, very dark gray (10YR 3/1) clay films on ped faces; firm; 5 percent limestone fragments; mildly alkaline; clear, wavy boundary.

IIB22tg—18 to 26 inches, dark-gray (10YR 4/1) clay; many, medium, distinct, yellowish-brown (10YR 5/4) mottles; weak, medium, prismatic structure parting to moderate, medium and coarse, subangular blocky; firm; few roots; thin, very dark gray (10YR 3/1) clay films that are continuous on vertical ped faces and patchy on horizontal ped faces; 5 percent limestone fragments; mildly alkaline; clear, wavy boundary.

IIIB3tg—26 to 30 inches, dark-gray (10YR 4/1) clay; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; very firm; few roots; thin, patchy dark-gray (10YR 4/1) clay films on ped faces; common, medium, distinct, black (10YR 2/1) stains and concretions; few limestone fragments; moderately alkaline; abrupt, wavy boundary.

IIIC—30 to 32 inches, light yellowish-brown (10YR 6/4) sandy clay loam; common, medium, distinct, grayish-brown (10YR 5/2) mottles; massive; very friable; 15 percent limestone fragments; moderately alkaline, calcareous.

IIIR—32 inches, limestone bedrock.

The solum is 20 to 40 inches thick, and the loess mantle, or drift mantle, is 6 to 15 inches thick. The solum is slightly acid to neutral in the A horizon, and it increases as depth increases to moderately alkaline in the B3 horizon.

The A horizon is black (10YR 2/1), very dark gray (10YR 3/1), or very dark brown (10YR 2/2).

The B horizon has a hue of 10YR, a chroma of 2 or less, and generally a value of 4 or 5, but in some profiles the upper part of the B horizon has a value of 2 or less. Mottles have a hue of 10YR and 7.5YR, a value of 5, and a chroma of 4 and 6. The B horizon is heavy silty clay loam, clay loam, silty clay, or clay. Thin, patchy or continuous, clay films are on vertical and horizontal ped faces. These clay films are very dark gray (10YR 3/1) and (N 3/0), dark gray (10YR 4/1) and (N 4/0), and gray (10YR 5/1). In some profiles the B3 horizon formed in fine-textured residuum that weathered from limestone.

Some profiles have a C horizon, 1 to 8 inches thick, of limestone residuum that is light brownish gray (10YR 6/2), pale brown (10YR 6/3), light yellowish brown (10YR 6/4), and yellowish brown (10YR 5/4). In other places the C horizon is glacial till 2 to 10 inches thick underlain by limestone bedrock.

The Millsdale soils are part of the drainage sequence that includes well-drained Milton soils. Millsdale soils differ from Brookston soils and Montgomery soils in that they are underlain by limestone bedrock rather than by glacial till. Unlike Gasconade soils, they are underlain by limestone bedrock at a depth of more than 20 inches.

Mt—Millsdale silty clay loam. This nearly level soil is in broad depressional areas and in narrow strips along waterways, on uplands, and on terraces. It is underlain by limestone bedrock. Areas of this soil cover 5 to 15 acres. They are adjacent to better drained Milton, Miamian, or Celina soils in many places and adjacent to the steep Hennepin and Miamian soils. It is subject to seepage and to ponding of long duration. In many places cloddiness in the surface layer results if this soil is worked when it is too wet.

Included with this soil in mapping are small areas of Millsdale soils that have a silt loam surface layer. Also included are a few small areas of Crosby soils and Brookston soils and an occasional knoll of the brown-colored Milton soils. In a few areas limestone bedrock is at a depth of less than 20 inches.

This soil is generally cultivated. Wetness is a limitation to farm use, but this soil is sometimes difficult or impractical to drain with tile because it is shallow to underlying bedrock. Shallowness to bedrock, very poor natural drainage, slow to moderate permeability, a seasonal high water table, and a high shrink-swell potential are limitations to nonfarm uses. Capability unit IIIw–3; woodland suitability group 2w1.

Milton Series

The Milton series consists of well-drained, gently sloping to moderately steep soils that formed in a thin layer of loess and glacial till over limestone bedrock. These soils are on glaciated uplands, and the glacial till is thin over the underlying limestone bedrock. The native vegetation was hardwood forest in which sugar maple, beech, oak, and hickory were dominant.

In a representative profile in a cultivated area, the surface layer is dark grayish-brown silt loam 9 inches thick. The subsoil extends to a depth of 29 inches. The upper 3 inches is yellowish-brown heavy silt loam. The next 4 inches is brown silty clay loam. The next 5 inches is dark yellowish-brown heavy clay loam. The next 8 inches is yellowish-brown clay. The substratum is light yellowish-brown and very pale-brown loam and sandy loam limestone residual material. Below a depth of 33 inches is limestone bedrock.

The available water capacity is medium in Milton soils. Permeability is moderately slow, and surface runoff is medium. The root zone is moderately deep and commonly medium acid to mildly alkaline.

Milton soils are used mostly for corn, soybeans, wheat, and grass-legume mixtures for hay and pasture. A considerable part of the more sloping acreage is in permanent pasture or woodland.

Representative profile of Milton silt loam, 2 to 6 percent slopes, in a cultivated field, 4½ miles north-northeast of Hillsboro, 4½ miles south-southwest of Bridges, 110 yards north of the intersection of State Route 138 and Kincaid Road, and 80 yards west of Kincaid Road, in Penn Township:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; friable; many roots; slightly acid; abrupt, smooth boundary.

B1—9 to 12 inches, yellowish-brown (10YR 5/4) heavy silt loam; moderate, medium and coarse, subangular blocky structure; firm; common roots; dark grayish-brown (10YR 4/2) material in old worm holes and root channels; medium acid; abrupt, wavy boundary.

IIB21t—12 to 16 inches, brown (10YR 4/3) silty clay loam; strong, fine and medium, angular and subangular blocky structure; firm; few roots; thin, patchy, dark yellowish-brown (10YR 4/4) clay films on vertical and horizontal ped faces; thin, very patchy silt coatings that are yellowish brown (10YR 5/4) when moist and pale brown (10YR 6/3) when dry, on vertical and horizontal ped faces; 5 percent pebbles; medium acid; clear, wavy boundary.

IIB22t—16 to 21 inches, dark yellowish-brown (10YR 4/4) heavy clay loam; strong, fine and medium, angular and subangular blocky structure; few roots; thin, patchy, brown (7.5YR 4/4) clay films on vertical and horizontal ped faces; thin, patchy, silt coatings that are yellowish-brown (10YR 5/4) when moist and pale-brown (10YR 6/3) when dry on vertical and horizontal ped faces; 10 percent pebbles; medium acid; clear, wavy boundary.

IIIB23t—21 to 29 inches, yellowish-brown (10YR 5/4) clay; weak, fine, prismatic structure parting to moderate, medium, subangular blocky; very firm; few roots; thin, patchy, brown (7.5YR 4/4) clay films on vertical and horizontal ped faces; common, fine, distinct, black (10YR 2/1) stains and concretions; 10 percent limestone fragments; neutral; abrupt, irregular boundary.

IIIC—29 to 33 inches, light yellowish-brown (10YR 6/4) and very pale brown (10YR 7/3) loam and sandy loam partly weathered limestone bedrock; massive; friable; few roots; dark yellowish-brown (10YR 4/4) tongues and pockets of material from the B2 horizon; 10 percent limestone fragments; mildly alkaline, calcareous; abrupt, wavy boundary.

IIIR—33 inches, limestone bedrock.

The thickness of the solum is 20 to 40 inches, and in some profiles it is less than the depth to bedrock. Depth to bedrock is 20 to 40 inches, and the thickness of the loess mantle is 0 to 18 inches. The solum is medium acid to neutral in the upper part and slightly acid to neutral in the lower part. The B2t horizon formed principally in glacial till, but the lower part of some profiles is residuum weathered from limestone that is as much as 14 inches thick.

The Ap horizon is dark grayish brown (10YR 4/2), brown (10YR 5/3), or dark brown (10YR 4/3). In undisturbed areas the A1 horizon is 2 to 4 inches thick and is very dark

grayish brown (10YR 3/2), very dark brown (10YR 2/2), or black (10YR 2/1). The A2 horizon is 3 to 6 inches thick and is pale brown (10YR 6/3) or yellowish brown (10YR 5/4).

The B horizon has a hue of 10YR, 7.5YR, and 5YR, a value of 4 and 5, and a chroma of 3 and 4. Thin or medium, patchy or continuous clay films are dark yellowish brown (10YR 4/4) or brown (7.5YR 4/4) or (10YR 4/3). This horizon is silty clay loam, clay loam, and clay.

Some profiles have a C horizon of residuum that weathered from limestone and is 1 to 8 inches thick. In this soil material are very pale-brown (10YR 7/3), light yellowish-brown (10YR 6/4) and dark yellowish-brown (10YR 4/4) tongues from the B2 horizon material. Other profiles have a C horizon of glacial till, 2 to 10 inches thick, that is yellowish brown (10YR 5/4) or brown (10YR 4/3).

Milton soils are part of the drainage sequence that includes dark-colored, very poorly drained Millsdale soils. Unlike Miamian soils, Milton soils are underlain by limestone bedrock at a depth of less than 40 inches. They are deeper to limestone bedrock than Opequon soils. Unlike Bratton soils, they formed partly in glacial till.

MuB—Milton silt loam, 2 to 6 percent slopes. This gently sloping soil is in broad convex areas, on ridges in the uplands, and on terraces. It is underlain by limestone bedrock. Areas of this soil vary widely in width and length. They cover 3 to 15 acres. This soil is adjacent to areas of Miamian, Celina, and other more sloping Milton soils, and in some places, to shallower, steeper Opequon soils. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of moderately eroded Milton soils and small areas of Millsdale soils in small drainageways. Also included are a few small areas of Miamian soils.

Erosion is a hazard on this soil. Erosion control is needed if this soil is used for cultivated crops. Depth to bedrock is a severe limitation to many nonfarm uses. Capability unit IIe–1; woodland suitability group 2o1.

MuB2—Milton silt loam, 2 to 6 percent slopes, moderately eroded. This gently sloping soil is in broad convex areas, on ridges in the uplands, and on terraces. It is underlain by limestone bedrock. Areas of this soil vary widely in width and length. They generally cover 3 to 15 acres.

This soil is adjacent to areas of Celina, Miamian, and other more sloping Milton soils. In some places it is next to the shallower, steeper Opequon soils. This soil has a profile similar to the one described as representative of the series, but the present plow layer is finer textured, browner subsoil material, because part of the original surface layer has been removed by erosion. As a result, the root zone is thinner, and the available water capacity is less.

Included with this soil in mapping are a few small areas of slightly eroded Milton and Miamian soils. A few areas of the shallower Opequon soils are also included.

Erosion is a moderate hazard on this soil and measures that control erosion are needed if this soil is cultivated. Depth to bedrock is a severe limitation to many nonfarm uses. Capability unit IIe–1; woodland suitability group 2o1.

MuC2—Milton silt loam, 6 to 12 percent slopes, moderately eroded. This sloping soil is on the sides of broad, slightly convex areas on uplands where the underlying bedrock is limestone and in narrow bands along major drainageways next to steeper areas. Areas of this soil cover 2 to 20 acres. This soil is next to Celina and Miamian soils in the broader areas of the uplands. Along drainageways it is generally next to Opequon soils. This soil has a profile similar to the one described as representative of the series, but the surface layer is thinner and a mixture of the original surface layer and subsoil.

Included with this soil in mapping are small areas of Miamian and Opequon soils. Also included are small areas of slightly eroded Milton soils in woodland and a few areas of severely eroded Milton soils.

Slope and erosion are limitations to farm use. Slope, erosion, and depth to bedrock are severe limitations to nonfarm uses. Capability unit IIIe-1; woodland suitability group 2o1.

MuD2—Milton silt loam, 12 to 18 percent slopes, moderately eroded. This moderately steep soil is mainly along streams and at the head of drainageways adjacent to steeper areas. The areas parallel the drainageways for several hundred feet. They are narrow, irregularly shaped, and elongated, and they cover 3 to 16 acres. The slopes are 70 to 100 feet long. This soil has a profile similar to the one described as representative of the series, but the surface layer is thinner and is a mixture of the original surface layer and the subsoil.

Included with this soil in mapping are areas of severely eroded Milton soils and areas of slightly eroded Milton soils in woodlands. Also included are Opequon soils in steeper areas and a few small areas of Miamian soils. Other inclusions are many rock outcrops (fig. 7), and a few springs at the middle or the base of the side slopes.

This soil is suited to permanent vegetation. Slope and erosion are severe limitations to use for cultivated crops. Depth to bedrock, slope, and erosion are severe limitations to nonfarm uses. Capability unit IVe–3; woodland suitability group 2r1.

MwC3—Milton clay loam, 6 to 12 percent slopes, severely eroded. This sloping soil is on uplands, mainly along the major drainageways and next to steeper areas but also on sides of broad, slightly convex areas. Along the drainageways it occurs as narrow bands. The areas of this soil cover 2 to 20 acres. This soil is next to Celina and Miamian soils in the broader areas on the uplands. Along drainageways it is generally next to Opequon soils. This soil has a profile similar to the one described as representative of the series, but the surface layer is made up chiefly of subsoil material and has a finer texture. This soil is dissected by many shallow gullies that expose

Figure 7.—Outcrop of limestone bedrock in an area of Milton soils.

bedrock in many places. It contains some loose rock fragments and rock outcrops, and many areas have no plant cover.

Included with this soil in mapping are areas of slightly eroded Milton soils in places where the cover of vegetation is permanent. Areas of moderately eroded Milton soils and areas of steeper, shallower Opequon soils are also included.

This soil is not well suited to crops because of the severe hazard of erosion, rockiness, and slope. It is better suited to permanent vegetation. Depth to bedrock, slope, and erosion are severe limitations to many nonfarm uses. Capability unit IVe–3; woodland suitability group 2o1.

Montgomery Series

The Montgomery series consists of very poorly drained, nearly level soils that formed in loess and the underlying lacustrine deposits. These soils are on lake plain areas of Wisconsin and Illinoian glaciation. The native vegetation was marsh grasses intermixed with hardwood forest, in which elm, sycamore, swamp and pin oak, ash, and soft maple were dominant.

In a representative profile in a cultivated area, the surface layer is black silty clay loam 16 inches thick. The subsoil extends to a depth of 42 inches. The upper 20 inches is dark-gray silty clay that has yellowish-brown and dark yellowish-brown mottles. The lower 6 inches is dark yellowish-brown silty clay that has gray and dark-gray mottles. The substratum extends to a depth of 60 inches and is yellowish-brown and dark yellowish-brown clay that has gray and dark-gray mottles.

The available water capacity is high in Montgomery soils. Permeability is slow to very slow, and surface runoff is slow to ponded. These soils have a high water table in spring and winter, and they dry out slowly after rain. The root zone is deep and is commonly slightly acid to neutral. Montgomery soils have a high content of organic matter in the surface layer.

Montgomery soils are used chiefly for corn, soybeans, wheat, and grass-legume mixtures for hay and pasture. A small acreage is in permanent pasture or woodland.

Representative profile of Montgomery silty clay loam, in a cultivated field 2¼ miles north of Boston, ¾ mile north of the intersection of Petersburg Road and Stony Point Road, 150 yards north of Stony Point Road, and 35 yards east of Dragoo Road, in Liberty Township:

Ap—0 to 10 inches, black (10YR 2/1) silty clay loam; moderate, fine and medium, subangular blocky structure; friable, many roots; slightly acid; clear, smooth boundary.

A12—10 to 16 inches, black (10YR 2/1) silty clay loam; moderate, medium, subangular blocky structure; friable; many roots; slightly acid; clear, smooth boundary.

B21tg—16 to 24 inches, dark-gray (10YR 4/1) silty clay; common, medium, distinct, yellowish-brown (10YR 5/4) and dark yellowish-brown (10YR 4/4) mottles; moderate, coarse, prismatic structure parting to moderate, medium, subangular blocky; firm; common roots, thin, very patchy, dark-gray (N 4/0) and gray (N 5/0) clay films on ped faces; 3 percent pebbles; slightly acid; gradual, wavy boundary.

B22tg—24 to 36 inches, dark-gray (10YR 4/1) silty clay; many, fine and medium, distinct, yellowish-brown (10YR 5/4) and dark yellowish-brown (10YR 4/4) mottles; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky; firm; rew roots; thin, patchy, dark-gray (N 4/0) and gray (N 5/0) clay films on ped faces; 3 percent pebbles; slightly acid; clear, wavy boundary.

B3t—36 to 42 inches, dark yellowish-brown (10YR 4/4) silty clay; many, fine and medium, distinct, gray (10YR 5/1) and dark-gray (10YR 4/1) mottles; weak, coarse, prismatic structure parting to weak, medium and coarse, subangular blocky firm; few roots; thin, patchy, dark-gray (N 4/0) clay films on vertical ped faces; neutral; gradual, wavy boundary.

C—42 to 60 inches, yellowish-brown (10YR 5/4) and dark yellowish-brown (10YR 4/4) clay; many, medium, distinct, dark-gray (10YR 4/1) and gray (10YR 5/1) mottles; weak, coarse, prismatic structure parting to weak, coarse, subangular blocky; firm; mildly alkaline, calcareous.

The solum is typically 30 to 42 inches thick, and in some places it is 26 to 48 inches thick. The solum is commonly slightly acid to neutral increasing to mildly alkaline in the lower part of some profiles.

The A horizon is 10 to 16 inches thick. The Ap and A1 horizons are black (10YR 2/1), very dark gray (10YR 3/1), and very dark brown (10YR 2/2) silt loam and silty clay loam.

The B horizon is heavy silty clay loam, silty clay, and clay. It is gray (10YR 5/1 and 6/1 and N 5/0) and dark gray (10YR 4/1 and N 4/0). It has mottles of yellowish brown (10YR 5/4 and 5/6) and dark yellowish brown (10YR 4/4), and dark brown (10YR 4/3). In some places the colors are reversed in the B3 horizon. The B horizon has thin, patchy and very patchy, clay films that are dark gray (10YR 4/1 and N 4/0), very dark gray (10YR 3/1 and N 3/0), and gray (10YR 5/1 and N 5/0).

The C horizon is yellowish brown (10YR 5/4 and 5/6) or dark yellowish brown (10YR 4/4) and dark brown (10YR 4/3). It has gray (10YR 5/1 and 6/1 and N 5/0) or dark-gray (10YR 4/1 and N 4/0) mottles. In some places the colors are reversed.

Some clay has moved into the B horizon, and this is not defined in the range for the series, but this difference does not alter the usefulness or behavior of the soils.

Montgomery soils are part of the drainage sequence that includes well drained and moderately well drained Markland soils and somewhat poorly drained McGary soils. Montgomery soils are underlain by fine textured lacustrine material, but Westland soils are underlain by sand and gravel, Brookston soils by glacial till, and Millsdale soils by limestone bedrock.

My—Montgomery silty clay loam. This nearly level soil is in broad, nearly flat to slightly depressional areas on glacial till plains, in fan-shaped areas at the head of drainageways, and in narrow strips along the drainageways. It is generally next to McGary and Markland soils or is associated with coarser textured soils on terraces. Areas of this soil cover 3 to 40 acres.

Included with this soil in mapping are Montgomery soils that are next to more sloping soils and have a silty deposit 6 to 12 inches thick. These included soils have a lighter colored surface layer. Also included are some small areas of McGary and Patton soils.

This soil is subject to ponding and to seepage from surrounding more sloping soils. Wetness is a moderate limitation for farming. Very poor natural drainage, slow to very slow permeability, the seasonal high water table, and a high shrink-swell potential are limitations for nonfarm uses. Capability unit IIIw–3; woodland suitability group 2w1.

Muse Series

The Muse series consists of well-drained, gently sloping to moderately steep soils that formed in loess and residuum weathered from shale bedrock. These soils are on benches, foot slopes, and uplands in the unglaciated part of the county. The native vegetation was deciduous and coniferous forest.

In a representative profile in a cultivated area, the surface layer is brown silt loam 7 inches thick. The subsurface layer is brown silt loam 5 inches thick. The subsoil extends to a depth of 45 inches. The upper 6 inches is dark yellowish-brown silty clay loam. The next 19 inches is reddish-brown silty clay. The lower 8 inches is dark-brown shaly silty clay loam that has light brownish-gray mottles. The substratum extends to a depth of 52 inches. It is dark-brown and yellowish-red shaly silty clay loam. Black shale bedrock is at a depth of 52 inches.

The available water capacity is medium to low in Muse soils. Permeability is slow, and surface runoff is medium. The root zone is moderately deep to deep and is commonly strongly acid to extremely acid.

Muse soils are mostly in forest. Some farm crops, such as corn, wheat, and tobacco, are grown in the less eroded, less sloping areas. A small acreage is in permanent pasture, and some areas are idle and are reverting to forest.

Representative profile of Muse silt loam, in an area of Trappist-Muse silt loams, 6 to 12 percent slopes, moderately eroded, in a cultivated field 1¾ miles south-southwest of Carmel, 1 mile south-southeast on Carmel Road from its intersection with Millburn Road, and 300 feet north of Carmel Road, in Brush Creek Township:

Ap—0 to 7 inches, brown (10YR 4/3) silt loam; moderate, medium, subangular blocky structure; friable; common roots; common tubular and vesicular pores; 5 percent shale fragments; medium acid; abrupt, smooth boundary.

A2—7 to 12 inches, brown (10YR 4/3) silt loam; weak, thick, platy structure; friable; common roots; common tubular and vesicular pores; 5 percent shale fragments; strongly acid; clear, wavy boundary.

IIB1t—12 to 18 inches, dark yellowish-brown (10YR 4/4) silty clay loam; moderate, fine and medium, subangular blocky structure; friable; common roots; common tubular and vesicular pores; thin, very patchy, reddish-brown (5YR 5/3) clay films on vertical somewhat irregular, rounded ped faces; 8 percent shale fragments; very strongly acid; clear, wavy boundary.

IIB21t—18 to 26 inches, reddish-brown (5YR 4/4) silty clay; moderate, medium and fine, subangular blocky structure; firm; few roots; common tubular pores; medium, patchy, dark reddish-brown (5YR 3/4) clay films on vertical and horizontal, somewhat irregular, rounded ped faces; 10 percent shale fragments; very strongly acid; gradual, wavy boundary.

IIB22t—26 to 37 inches, reddish-brown (5YR 4/4) silty clay; moderate, medium, subangular blocky structure parting to strong, fine, angular blocky; firm; few roots; common tubular pores; thin and medium, patchy, dark reddish-brown (5YR 3/4) clay films on vertical and horizontal, somewhat irregular, rounded ped faces; 10 percent shale fragments; very strongly acid; clear, wavy boundary.

IIB3—37 to 45 inches, dark-brown (7.5YR 4/4) shaly silty clay loam; common, medium, prominent, light brownish-gray (10YR 6/2) mottles; moderate, medium and coarse, subangular blocky structure; firm; few roots; common tubular pores; dark yellowish-brown (10YR 4/4), light yellowish-brown (10YR 6/4), and reddish-brown (5YR 4/4) coatings on shale fragments; 15 to 20 percent shale fragments; extremely acid; gradual, wavy boundary.

IIC—45 to 52 inches, dark-brown (7.5YR 4/4) and yellowish-red (5YR 4/6) shaly silty clay loam; moderate, thin and medium, platy structure and pockets of weak, coarse, subangular blocky structure; firm to very firm; light yellowish-brown (10YR 6/4) and pink (7.5YR 7/4) coatings on shale fragments; 35 to 45 percent of partly weathered shale fragments; extremely acid; gradual, smooth boundary.

IIR—52 inches, acid, black, fissile shale.

The solum is 40 to 60 inches thick, and the depth to shale bedrock ranges from 40 to 80 inches. Reaction in the solum ranges from strongly acid to extremely acid.

The Ap horizon is brown (10YR 5/3 and 10YR 4/3) or yellowish-brown (10YR 5/4). Profiles in undisturbed areas have an A1 horizon that is 1 to 3 inches thick and is of very dark grayish brown (10YR 3/2), dark grayish brown (10YR 4/2), or dark gray (10YR 4/1). The A2 horizon is commonly brown (10YR 5/3), but in places it is yellowish brown (10YR 5/4) or brown (10YR 4/3). The A horizon developed in a loess mantle 12 to 18 inches thick.

The B horizon has a hue of 5YR, 7.5YR, and 10YR, value of 4 and 5, and chroma of 3 through 6. It is silty clay loam, silty clay, or clay. The B3 horizon is shaly.

Soft shale fragments make up 5 to 60 percent of the C horizon. The C horizon matrix and shale fragment coatings are variegated and have a hue of 5YR to 10YR.

Muse soils are next to Trappist and Colyer soils. They are deeper to shale bedrock than Trappist and Colyer soils. They formed in material weathered from shale, but Wellston soils formed in material weathered from sandstone. Unlike Jessup soils, they are underlain by acid shale bedrock.

In Highland County, soils are mapped only in complexes with Trappist soils.

Muskingum Series

The Muskingum series consists of well-drained, sloping to very steep soils that formed in residuum weathered from sandstone. These soils are on ridgetops, toe slopes or benches, and rugged unglaciated uplands. The native vegetation was hardwood forest in which white, red, and black oaks, sugar maple, yellow-poplar, and dogwood were dominant.

In a representative profile in a wooded area, the surface layer is very dark grayish-brown silt loam 2 inches thick. The subsurface layer is yellowish-brown channery silt loam 4 inches thick. The subsoil extends to a depth of 20 inches and is brown channery silt loam. The substratum is yellowish-brown channery loam to a depth of 25 inches. Sandstone bedrock is at a depth of 25 inches.

The available water capacity is low to medium in Muskingum soils. Permeability is moderate, and surface runoff is medium to rapid. The root zone is moderately deep and is commonly strongly acid to very strongly acid.

Some areas of the less sloping Muskingum soils are in wheat, oats, corn, grass-legume mixtures for hay and pasture, and tobacco. Most areas are in forest, or they are idle and are reverting to forest.

Representative profile of Muskingum silt loam, in an area of Berks-Muskingum channery silt loams, 18 to 35 percent slopes, in a wooded area 2¼ miles west of Sinking Spring, 1 mile south of the intersection of Sinking Spring West Road and Cedar Chapel Road, and 380 yards east of farmhouse on High Knob, in Brush Creek Township:

O1—3 inches to 1 inch, deciduous leaf litter.

O2—1 inch to 0, deciduous leaf litter, partly decomposed.

A1—0 to 2 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine, granular structure; very friable; many roots; 10 percent sandstone fragments; medium acid; abrupt, wavy boundary.

A2—2 to 6 inches, yellowish-brown (10YR 5/4) channery silt loam; weak, thick, platy structure parting to moderate, fine and medium, granular; very friable; many roots; dark grayish-brown (10YR 4/2) organic stains in old root channels, in pores, and on some ped faces; 15 percent sandstone fragments; strongly acid; clear, wavy boundary.

B1—6 to 13 inches, brown (7.5YR 5/4) channery silt loam; weak, fine and very fine, subangular blocky structure; friable; many roots; dark grayish-brown (10YR 4/2)

organic stains in old root channels and in pores; 15 percent sandstone fragments; very strongly acid; gradual, wavy boundary.

B2—13 to 20 inches, brown (7.5YR 4/4) channery silt loam; weak, fine and medium, subangular blocky structure; friable; common roots; thin, very patchy, silt coatings of pale brown (10YR 6/3) when moist and light gray (10YR 7/2) when dry on ped faces; thin, strong-brown (7.5YR 5/6) and brown (10YR 4/3) coatings of weathered material on sandstone fragments; 30 percent sandstone fragments; very strongly acid; wavy boundary.

C—20 to 25 inches, yellowish-brown (10YR 5/4) channery loam; very friable; few roots; thin, very patchy, silt coatings, pale brown (10YR 6/3) when moist and light gray (10YR 7/2) when dry on ped faces; thin, strong-brown (7.5YR 5/6), yellowish-red (5YR 4/6), and light brownish-gray (10YR 6/2) coatings of weathered material on fragments; 50 percent sandstone fragments; very strongly acid; gradual, wavy boundary.

R—25 inches, fine-grained sandstone bedrock.

The solum is 16 to 36 inches thick, and the depth to sandstone bedrock is 20 to 40 inches. Reaction in the B and C horizons is very strongly acid or extremely acid. Coarse fragments of sandstone make up 10 to 20 percent of the A horizon, 15 to 35 percent of the B horizon, and 35 to 70 percent of the C horizon.

The A horizon is silt loam or channery silt loam. The Ap horizon is dark grayish brown (10YR 4/2), yellowish brown (10YR 5/4), or brown (10YR 4/3 and 5/3). Profiles in undisturbed areas have an A1 horizon that is 1 to 3 inches thick and is very dark grayish brown (10YR 3/2) or dark brown (10YR 3/3).

The B horizon is yellowish brown (10YR 5/4 and 5/6) or brown (7.5YR 5/4 and 4/4). It is channery silt loam, channery loam, or channery light silty clay loam.

The C horizon has a hue of 7.5YR and 10YR, value of 4 and 5, and chroma of 4 and 6. Some profiles have thin, patchy and very patchy, pale-brown (10YR 6/3) or light yellowish-brown (10YR 6/4) silt coatings in the lower horizons.

Muskingum soils are near or adjacent to well-drained Berks and Neotoma soils. They lack the dark-colored A horizon and more clayey B horizon and are not so deep to sandstone bedrock as Neotoma soils. Muskingum soils have fewer coarse fragments in the solum than Berks soils. They have a less clayey B horizon and are shallower to bedrock than Wellston soils.

In Highland County, Muskingum soils are mapped only in complexes with Berks and Neotoma soils.

Negley Series

The Negley series consists of well-drained, gently sloping to very steep soils that formed in thin deposits of loess and highly weathered outwash material that is underlain by sand and gravel of Illinoian age (fig. 8). Negley soils are on dissected outwash plains, high stream terraces, valley trains, and in areas of kames. The native vegetation was deciduous forest, principally of oak and hickory.

In a representative profile in a cultivated area, the surface layer is brown loam 8 inches thick. The subsoil extends to a depth of 126 inches. In sequence downward, it is 6 inches of strong-brown loam, 10 inches of brown loam, 9 inches of yellowish-red gravelly clay loam, 9 inches of yellowish-red gravelly sandy clay loam, 15 inches of yellowish-red sandy clay loam, 15 inches of yellowish-red sandy clay, 20 inches of reddish-brown sandy clay loam, 16 inches of yellowish-brown coarse sandy loam, and 18 inches of dark yellowish-brown coarse sandy loam. The substratum, to a depth of 156 inches, is yellowish-brown loose sand and gravel.

The available water capacity is medium in Negley soils. Permeability is moderate to moderately rapid, and surface runoff is medium to rapid, depending on the slope. The root zone is deep and is commonly medium acid to very strongly acid. These soils are somewhat droughty during dry seasons.

Figure 8.—**In this gravel pit are exposed the strata of gravel and sand in which the Negley soils formed.**

Negley soils are used mostly for corn, wheat, grass-legume forage for hay and pasture, and tobacco. A considerable acreage in the steeper areas is in permanent pasture or forest. Some of the more eroded steeper areas are idle and reverting to forest.

Representative profile of Negley loam, 6 to 12 percent slopes, in a cultivated field, 2 miles south of Hillsboro, 225 feet west of State route 247 and ⅛ mile south of Rocky Fork Creek, in Liberty Township:

Ap—0 to 8 inches, brown (10YR 4/3) loam; weak, medium, granular structure; friable; 8 percent glacial pebbles; neutral; abrupt, smooth boundary.

B1—8 to 14 inches, strong-brown (7.5YR 5/6) loam; weak, medium, subangular blocky structure; friable; 8 percent glacial pebbles; medium acid; clear, wavy boundary.

B21t—14 to 24 inches, brown (7.5YR 5/4) loam; many, medium, distinct, yellowish-red (5YR 4/6) mottles; moderate, fine and medium, subangular blocky structure; friable; few roots; thin, very patchy yellowish-brown (10YR 5/4) clay films on ped faces; common, very dark brown (10YR 2/2) concretions and stains; 12 percent glacial pebbles; medium acid; clear, wavy boundary.

B22t—24 to 33 inches, yellowish-red (5YR 4/6) gravelly clay loam; common, medium and coarse, distinct, brown (10YR 5/3) mottles; moderate, fine and medium, subangular blocky structure; firm; thin, very patchy

yellowish-brown (10YR 5/4) and reddish-brown (5YR 4/4) clay films on ped faces; common, fine and medium, very dark brown (10YR 2/2) stains and concretions; 20 percent pebbles; strongly acid; gradual, wavy boundary.

B23t—33 to 42 inches, yellowish-red (5YR 4/6) gravelly sandy clay loam; common, medium, distinct, brown (10YR 5/3) mottles; moderate, medium and coarse, subangular blocky structure; firm; thin, patchy, yellowish-brown (10YR 5/4) and reddish-brown (5YR 4/4) clay films on ped faces; common, fine and medium, very dark brown (10YR 2/2) stains and concretions; 20 percent pebbles; strongly acid; gradual, wavy boundary.

B24t—42 to 57 inches, yellowish-red (5YR 4/6) sandy clay loam; common, medium, distinct, brown (10YR 5/3) mottles; weak, medium, subangular blocky structure; friable; few, fine, very dark brown (10YR 2/2) stains and concretions; 8 percent glacial pebbles; very strongly acid; gradual, wavy boundary.

B25t—57 to 72 inches, yellowish-red (5YR 4/6) sandy clay; common, medium, distinct, brown (10YR 5/3) mottles; weak, medium, subangular blocky structure; friable; few, fine, very dark brown (10YR 2/2) stains and concretions; 8 percent glacial pebbles; strongly acid; gradual, wavy boundary.

B31t—72 to 92 inches, reddish-brown (5YR 4/4) sandy clay loam; common, medium, distinct, yellowish-brown (10YR 5/4) mottles; weak, coarse, subangular blocky structure; friable; common, fine, very dark brown (10YR 2/2) stains and concretions; 8 percent glacial pebbles; strongly acid; gradual, wavy boundary.

B32—92 to 108 inches, yellowish-brown (10YR 5/4) coarse sandy loam; common, medium, distinct, brown (7.5YR 4/4) mottles; partly weathered yellowish-brown (10YR 5/6 and 5/8) and brownish-yellow (10YR 6/8) pebbles and stones; massive; firm; 6 percent glacial pebbles; medium acid; abrupt, wavy boundary.

B33—108 to 126 inches, dark yellowish-brown (10YR 4/4) coarse sandy loam; single grained; very friable; 10 percent glacial pebbles; slightly acid; gradual, wavy boundary.

C—126 to 156 inches, yellowish-brown (10YR 5/4) sand and gravel; single grained, loose; calcareous.

The solum is 80 to 150 inches thick and the depth to carbonates is more than 80 inches. The solum is 5 to 25 percent pebbles, except in some profiles where the loess mantle is as much as 18 inches thick.

The A horizon is dark grayish brown (10YR 4/2), brown (10YR 4/3), or yellowish brown (10YR 5/4) silt loam, loam, and clay loam.

The B horizon has a hue of 5YR, 7.5YR, and 10YR, a value of 4 and 5, and a chroma of 4 and 6. The B1 and B2 horizons are loam, clay loam, sandy clay loam, and sandy clay 30 to 60 inches thick, and the B3 horizon is sandy loam. The B horizon is gravelly in many places. The B1 and B2 horizons range from medium acid to very strongly acid and the B3 horizon from strongly acid to neutral.

The C horizon has a hue of 7.5YR and 10YR, a value of 4 and 5, and a chroma of 3 through 6.

Negley soils are closely associated with the well-drained Otwell soils and the moderately well drained Haubstadt soils. Negley soils lack a fragipan, but Otwell soils have one. Unlike Casco and Fox soils, they are more than 7 feet deep to calcareous sand and gravel. Negley soils have a thicker solum than Kendallville soils and they are underlain by sand and gravel.

NdC—Negley loam, 6 to 12 percent slopes. This sloping soil is generally on kames, eskers, and outwash terraces, but in some places it is on benches and banks along flood plains. Most areas are irregularly shaped and dissected by drainageways. They cover about 2 to 30 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of moderately eroded Negley soils. Also included along the edges of the uplands are areas of Rossmoyne and Cincinnati soils, and along the edges of finer textured outwash and alluvium are areas of Haubstadt and Otwell soils. In some places along streams areas of Boston and Grayford soils are included.

Slope and erosion are moderate limitations to farm uses. Slope is a limitation to nonfarm uses. Capability unit IIIe-4; woodland suitability group 2o1.

NdD—Negley loam, 12 to 18 percent slopes. This moderately steep soil is generally on kames, eskers, and outwash terraces, but in some places it is on benches and banks along flood plains. Most areas are irregularly shaped and dissected by drainageways. They cover about 2 to 40 acres.

Included with this soil in mapping are sizable areas of moderately eroded Negley soils. Also included along the uplands are areas of Rossmoyne and Cincinnati soils and along the edges of this soil are areas of Haubstadt and Otwell soils. In some places along streams, areas of Boston and Grayford soils are included.

The slope and erosion are severe limitations to farm and nonfarm uses. Capability unit IVe-4; woodland suitability group 2r1.

NdE—Negley loam, 18 to 25 percent slopes. This steep soil is on banks along flood plains of streams or on short steep breaks. The breaks are between less sloping terraces that are at a different elevation. Areas cover 2 to 30 acres. This soil has a profile similar to the one described as representative of the series, but the surface layer is thinner and contains more sand. Areas of this soil that are in permanent vegetation have a thin, dark-colored surface layer.

Included with this soil in mapping are areas of moderately eroded and severely eroded Fox soils and Casco soils. Compared with this Negley soil, the Fox soils are less steep, and in some places the Casco soils are steeper. Also included are areas of Otwell soils, and in some places along flood plains areas of Opequon soils.

Slope and erosion are severe limitations to both farm and nonfarm uses. This soil is suited to permanent vegetation. Capability unit VIe–1; woodland suitability group 2r1.

NdF—Negley loam, 25 to 35 percent slopes. This very steep soil is on banks along flood plains or on very steep breaks. The breaks are between less sloping terraces that are at a different elevation. Areas cover 2 to more than 50 acres. This soil has a profile similar to the one described as representative of the series, but the surface layer is thinner and contains more sand. Areas of this soil that are in permanent vegetation have a thin, dark-colored surface layer.

Included with this soil in mapping are areas of moderately and severely eroded, steeper Negley soils. Also included are areas of moderately and severely eroded Fox soils and Casco soils. The Fox soils are less steep than this Negley soil, but the Casco soils are steeper in places. In some places along flood plains areas of Opequon soils are included.

Slope and erosion are severe limitations both to farm and nonfarm uses. This soil is suited to permanent vegetation. Capability unit VIIe–1; woodland suitability group 2r1.

NeB—Negley silt loam, 2 to 6 percent slopes. This gently sloping soil is on low rounded humps and on the

ridges, breaks, and benches of terraces. Areas cover 2 to 20 acres. This soil has a profile similar to the one described as representative of the series, but the surface layer is thicker and is silt loam.

Included with this soil in mapping along the edges of the uplands are areas of Rossmoyne and Cincinnati soils. Also included along the edges of finer textured outwash and alluvium are areas of Haubstadt soils. Other inclusions are small areas, less than ½ acre, that are droughty because they have layers of loose sand and gravel near the surface.

Erosion is the main hazard. Rapid permeability in the underlying sand and gravel is a limitation to some nonfarm uses. Capability unit IIe–3; woodland suitability group 2o1.

NfC3—Negley clay loam, 6 to 12 percent slopes, severely eroded. This sloping soil is generally on kames, eskers, outwash terraces and on benches and breaks along flood plains. In some places it is on breaks that separate less sloping areas of terrace from other areas at a different elevation. Areas are 2 to 20 acres. This soil has a profile similar to the one described as representative of the series, but the surface layer has more sand and gravel. Erosion has removed the original surface layer, and the present surface layer is dissected by small gullies. This layer has many pebbles and small boulders.

Included with this soil in mapping are Fox soils. Also included are less eroded areas of Haubstadt and Otwell soils.

This is a droughty soil. Slope erosion, and droughtiness are severe limitations to farm use. Excavations for sand and gravel are common. Rapid permeability of the underlying gravel and sand, slope, and erosion are limitations to nonfarm uses. Capability unit IVe–4; woodland suitability group 2o1.

NfD3—Negley clay loam, 12 to 18 percent slopes, severely eroded. This moderately steep soil is generally on kames, eskers, outwash terraces, and on benches and breaks along flood plains. In some places it is on breaks that separate less sloping areas of terrace from other areas at a different elevation. Areas are 2 to more than 30 acres. This soil has a profile similar to the one described as representative of the series, but the surface layer has more sand and gravel. Erosion has removed the original surface layer. The present surface layer is dissected by small gullies, and it has many pebbles and small boulders.

Included with this soil in mapping are Fox soils and Casco soils. Also included are less eroded areas of Haubstadt and Otwell soils.

Slope, erosion, and droughtiness are severe limitations to farm uses. Excavations for sand and gravel are common. Rapid permeability of the underlying gravel and sand, slope, and erosion are limitations to nonfarm uses. Capability unit VIe–1; woodland suitability group 2r1.

NgF—Negley-Fox complex, 18 to 35 percent slopes. These steep soils are on terraces, along streams and drainageways, and on irregularly shaped kames, eskers, and sides of moraines. Along the streams and drainageways, they occur as somewhat narrow bands. Areas of this complex cover 10 to 50 acres. This mapping unit is about 60 percent Negley soils and 40 percent Fox and other soils. The soils in this mapping unit form such an intricate pattern that it is not practical to separate them at the scale of mapping used.

Included with these soils in mapping are areas of moderately and severely eroded Negley and Fox soils that have a surface layer of clay loam or sandy loam but with considerable gravel exposed at the surface. Also included are areas of steeper Negley and Fox soils. Casco and Otwell soils are included in places.

Most areas of this complex are in pasture or woodland. The slope, erosion, and droughtiness are severe limitations to farm and nonfarm uses. These soils are suited to recreation. Capability unit VIe–1; woodland suitability group 2r1.

Neotoma Series

The Neotoma series consists of well-drained, moderately steep to very steep soils that formed in residuum weathered from sandstone. These soils are generally on north- or east-facing slopes or in coves of the unglaciated uplands. The native vegetation was hardwood forest in which red and black oaks, sugar maple, and yellow-poplar were dominant.

In a representative profile in a wooded area, the surface layer is very dark brown channery silt loam 7 inches thick. The subsurface layer is brown channery silt loam 6 inches thick. The subsoil extends to a depth of 54 inches. The upper 8 inches is light yellowish-brown channery silt loam. The next 11 inches is yellowish-brown channery silt loam. The next 8 inches is yellowish-brown very channery loam. The lower 14 inches is yellowish-brown very flaggy loam. The substratum, to a depth of 60 inches, is mostly sandstone fragments coated with a yellowish-brown loamy material. Below a depth of 60 inches is sandstone bedrock.

The available water capacity is medium in Neotoma soils. Permeability is moderate to moderately rapid, and surface runoff is medium to rapid. The root zone is deep, and is commonly slightly acid to strongly acid. The surface layer is moderate to high in content of organic matter.

Neotoma soils are mostly in forest. Small areas that were cleared for pasture are now idle and reverting to forest.

Representative profile of Neotoma channery silt loam, in an area of Berks-Muskingum-Neotoma channery silt loams, 18 to 35 percent slopes, in a wooded area, 3¾ miles south-southeast of Rainsboro on Barrett Mill Road, 1½ miles east-southeast of the intersection of Barrett Mill and Cave Road, 330 yards east of Barrett Road on McNary Hill, in Paint Township:

O1—3 inches to 1 inch, leaf litter from deciduous hardwoods.
O2—1 inch to 0, partly decomposed leaf litter from deciduous hardwoods.
A1—0 to 7 inches, very dark brown (10YR 2/2) channery silt loam; moderate, fine, granular structure; very friable; many roots; 30 percent sandstone fragments; slightly acid; clear, wavy boundary.
A2—7 to 13 inches, brown (10YR 4/3) channery silt loam; moderate, fine and medium, granular structure; very friable; many roots; very dark brown (10YR 2/2) material in old root channels; 35 percent sandstone fragments; medium acid; clear, wavy boundary.
B1—13 to 21 inches, light yellowish-brown (10YR 6/4) channery silt loam; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, fine and medium, subangular blocky structure; very friable; common roots; thin, very patchy, pale-brown (10YR 6/3) and very pale brown (10YR 7/3) silt coatings on vertical and

horizontal ped faces; 45 percent sandstone fragments; slightly acid; clear, smooth boundary.

B21t—21 to 32 inches, yellowish-brown (10YR 5/6) channery silt loam; weak, fine and medium, subangular blocky structure; friable; few roots; thin, very patchy, yellowish-brown (10YR 5/4) and light yellowish-brown (10YR 6/4) clay films in old root channels, on sand grains, and on vertical and horizontal ped faces; thin, strong-brown (7.5YR 5/6) coatings on faces of some sandstone fragments; 60 percent sandstone fragments; slightly acid; gradual, smooth boundary.

B22t—32 to 40 inches, yellowish-brown (10YR 5/4) very channery loam; weak, fine medium, subangular blocky structure; friable; few roots; thin, very patchy, brown (7.5YR 5/4 and 4/4) clay films in old root channels, on sand grains and on ped faces; 70 percent sandstone fragments; slightly acid; diffuse, wavy boundary.

B3—40 to 54 inches, yellowish-brown (10YR 5/6) very flaggy loam; very weak, fine, subangular blocky structure; friable; few roots; 70 percent flaggy and channery sandstone fragments; strongly acid; diffuse, wavy boundary.

C—54 to 60 inches, yellowish-brown (10YR 5/6) loamy material as a coating on sandstone fragments; friable; 90 percent sandstone fragments; strongly acid; diffuse, wavy boundary.

R—60 inches, acid Berea sandstone; some fractures that decrease in number with increasing depth; a thin zone of slightly weathered loamy material on the surface of some of the fragments.

The solum is 36 to 54 inches thick, and the depth to bedrock is 40 to 60 inches. Content of channery- and flaggy-size sandstone fragments is 20 to 50 percent in the upper part of the solum and more than 50 percent in the lower part. The solum ranges from slightly acid to strongly acid in the A horizon and upper part of the B horizon to very strongly acid in the lower part of the B horizon.

The A1 horizon is very dark grayish brown (10YR 3/2), very dark brown (10YR 2/2), or black (10YR 2/1) and is, typically, 6 to 10 inches thick. The A2 horizon, if any, is brown (10YR 4/3 and 5/3) or light yellowish brown (10YR 6/4) and 3 to 8 inches thick. Instead of an A2 horizon, some profiles have an A3 horizon that is similar in color and thickness.

The B horizon is yellowish brown (10YR 5/4 and 5/6), light yellowish brown (10YR 6/4), brown (7.5YR 5/4), or strong brown (7.5YR 5/6). The B2t horizon is silt loam and loam, or channery, very channery, or flaggy silt loam or loam 12 to 24 inches thick. The B2t horizon has thin, patchy, yellowish-brown (10YR 5/4) or brown (7.5YR 5/4 and 4/4) clay films in pores and on ped faces. The B3 horizon is dominantly loam.

The C horizon has a hue of 7.5YR and 10YR, a value of 5 and 6, and a chroma of 4 and 6.

Neotoma soils are near or adjacent to well-drained Berks and Muskingum soils, but Neotoma soils are deeper to sandstone bedrock and are less acid than those soils. They have a thicker, darker-colored A1 horizon than Tuscarawas soils, and they are underlain by sandstone rather than by shale bedrock.

Neotoma soils are mapped only in a complex with Berks and Muskingum soils.

Nicholson Series

The Nicholson series consists of well drained and moderately well drained, gently sloping and sloping soils that formed in loess and in residual material weathered from limestone. They are on uplands in the southeastern part of the county. The native vegetation was a hardwood forest of beech, oak, maple, hickory, and yellow-poplar.

In a representative profile in a cultivated area, the surface layer is brown silt loam 8 inches thick. The subsoil extends to a depth of 74 inches. The upper 6 inches is yellowish-brown silt loam mottled with a lighter shade of yellowish brown. The next 10 inches is yellowish-brown silt loam that has light yellowish-brown mottles. The next 10 inches is dark yellowish-brown, firm and brittle silt loam that has yellowish-brown and light brownish-gray mottles. The next 8 inches is yellowish-brown, firm and slightly brittle silty clay loam that has light brownish-gray and strong-brown mottles. The next 8 inches is yellowish-red clay that has light olive-brown mottles. The next 17 inches is strong-brown clay that has light olive-brown mottles. The lower 7 inches is strong-brown silty clay that has light olive-brown and gray mottles. Below a depth of 74 inches is limestone bedrock.

The available water capacity is medium in Nicholson soils. Permeability is slow, and surface runoff is medium. The root zone is moderately deep and is medium acid to very strongly acid.

Nicholson soils are used mainly for corn, wheat, and grass-legume mixtures grown for hay and pasture. Some soybeans and tobacco are also grown. A considerable acreage is in permanent pasture, and a small acreage is in woodland or is idle.

Representative profile of Nicholson silt loam, 2 to 6 percent slopes, in a cultivated field, ¼ mile south of Elmville on Elmville South Road, and 1.4 miles southwest on and 140 yards west of Walnut Shade Road, in Brush Creek Township:

Ap—0 to 8 inches, brown (10YR 5/3) silt loam; moderate, fine and medium, subangular blocky structure; very friable; many roots, strongly acid; abrupt, smooth boundary.

B1—8 to 14 inches, yellowish-brown (10YR 5/4) silt loam; many, medium, faint, yellowish-brown (10YR 5/6) mottles; vertical tongues and small pockets of grayish-brown (10YR 5/2) material from the Ap horizon extend into the upper part of this horizon; weak, fine and medium, subangular blocky structure; friable; common roots; medium acid; clear, wavy boundary.

B2t—14 to 24 inches, yellowish-brown (10YR 5/6) silt loam; common, medium, faint, light yellowish-brown (10YR 6/4) mottles; moderate, fine and medium, subangular blocky structure; firm, few roots; thin, patchy, brown (7.5YR 4/4) clay films on vertical and horizontal ped faces; thin, patchy silt coatings that are pale brown (10YR 6/3) when moist and white (10YR 8/2) when dry on vertical and horizontal ped faces; common, fine, prominent, black (10YR 2/1) concretions; strongly acid; abrupt, wavy boundary.

Bx1—24 to 34 inches, dark yellowish-brown (10YR 4/4) silt loam; common, medium, distinct, yellowish-brown (10YR 5/6) and light brownish-gray (10YR 6/2) mottles; weak, very coarse, prismatic structure parting to moderate, fine and medium, subangular blocky; firm and brittle; few roots; thin, patchy, brown (7.5YR 4/4) clay films on horizontal ped faces and medium, patchy, gray (10YR 5/1) clay films on vertical ped faces; thin, continuous, silt coatings that are pale brown (10YR 6/3) when moist and white (10YR 8/2) when dry, on vertical and horizontal ped faces; common, fine, prominent, black (10YR 2/1) concretions; strongly acid; clear, wavy boundary.

IIBx2—34 to 42 inches, yellowish-brown (10YR 5/6) silty clay loam; common, fine, distinct, light brownish-gray (10YR 6/2) and common, medium, distinct, brown (7.5YR 4/4) and strong-brown (7.5YR 5/6) mottles; moderate, very thick platy structure parting to moderate, medium, subangular blocky; firm and slightly brittle; thin, patchy, grayish-brown (10YR 5/2) clay films on vertical ped faces; thin, very patchy silt coating of pale brown (10YR 6/3) when moist and white (10YR 8/2) when dry; many, medium, prominent, black (10YR 2/1) stains and concretions; slightly acid; clear, wavy boundary.

IIB31—42 to 50 inches, yellowish-red (5YR 4/6) clay; common, fine, prominent, light olive-brown (2.5Y 5/4) mottles; strong, very fine and fine, angular blocky structure; very firm; yellowish-brown (10YR 5/4) pressure faces on diagonal horizontal ped faces;

many, fine, prominent, black (10YR 2/1) stains and concretions; neutral; gradual, wavy boundary.

IIB32—50 to 67 inches, strong-brown (7.5YR 5/6) clay; common, fine, distinct, light olive-brown (2.5Y 5/4) mottles; moderate and strong, very fine and fine, angular blocky structure; very firm; yellowish-brown (10YR 5/4) pressure faces on horizontal ped faces; many, fine, prominent, black (10YR 2/1) stains and concretions; neutral; clear, wavy boundary.

IIB33—67 to 74 inches, strong-brown (7.5YR 5/8) silty clay; common, fine, distinct mottles of light olive brown (2.5Y 5/4) and few, fine, distinct mottles of gray (10YR 6/1); massive; firm; common, fine, prominent, black (10YR 2/1) stains and concretions; mildly alkaline; abrupt, wavy boundary.

IIR—74 inches, limestone bedrock.

The solum is 42 to 80 inches thick. The depth to limestone bedrock is 48 to 90 inches in most places but 50 to 75 inches in some places. Depth to the fragipan is 20 to 30 inches. The solum ranges from medium acid to very strongly acid from the Ap horizon through the fragipan and to mildly alkaline in the lower part of the solum.

The Ap horizon is dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), and brown (10YR 4/3 and 5/3). In undisturbed areas, the A1 horizon is very dark grayish brown (10YR 3/2), very dark gray (10YR 3/1), or dark gray (10YR 4/1) and 1 to 4 inches thick. In some profiles the A2 horizon is light yellowish brown (10YR 6/4), pale brown (10YR 6/3), brown (10YR 5/3 and 4/3), or grayish brown (10YR 5/2) and 2 to 8 inches thick.

The B horizon and the fragipan have a hue of 10YR and 7.5YR, a value of 3 through 5, and a chroma of 4 or 6. The B1 horizon is silt loam, and the B2 horizon is silt loam or silty clay loam. In some profiles, the mottles below the upper 10 inches of the B2 horizon have a hue of 10YR, a value of 5 or 6, and a chroma of 1 or 2. The fragipan is silt loam and silty clay loam. The B2 and Bx horizons have thin to medium, very patchy and patchy clay films in a hue of 10YR or 7.5YR, a value of 3 through 5, and a chroma of 1 through 6. In these horizons are silt coatings of pale brown (10YR 6/3), light yellowish brown (10YR 6/4), and light gray (10YR 7/1 and 7/2) on the ped faces. The B3 horizon is yellowish red (5YR 4/6), reddish brown (5YR 4/4 and 4/3), strong brown (7.5YR 5/6 and 5/8), reddish brown (2.5YR 4/4), or red (2.5YR 4/6).

In some profiles the C horizon has variegated colors of pale brown (10YR 6/3), light yellowish brown (10YR 6/4), light gray (10YR 6/1), or yellowish brown (10YR 5/4 and 5/6). This horizon is clay loam to sandy loam.

Nicholson soils are adjacent to or closely associated with well-drained Bratton soils. They are deeper to limestone bedrock than Bratton soils, and they have a fragipan. Unlike Johnsburg soils, Nicholson soils are underlain by limestone bedrock. They lack stratification in the lower part of the solum, but Otwell soils are stratified in the lower part of the solum.

NnB—Nicholson silt loam, 2 to 6 percent slopes. This gently sloping soil is on the tops of ridges and along minor drainageways. On the tops of ridges, the areas are long and narrow to broad, but along minor drainageways where the soils have short slopes, they occur as narrow bands. The soil areas are both concave and convex. They cover 1 to 76 acres but generally are 3 to 25 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of moderately eroded Nicholson soils and moderately eroded, sloping Bratton soils. Also included are a few areas of a somewhat poorly drained soil that occurs as narrow bands along drainageways as well as in depressions at the head of drainageways. In some areas of this soil are a few areas of broad and shallow sinkholes and small, deep, uncrossable depressions.

The hazard of erosion is moderate, and some measures for controlling erosion are needed if cultivated crops are grown. Depth to bedrock and slow permeability are limitations to nonfarm uses. Capability unit IIe–2; woodland suitability group 2o1.

NnB2—Nicholson silt loam, 2 to 6 percent slopes, moderately eroded. In most places this gently sloping soil occurs as long, narrow and medium bands at the head of and along minor drainageways; in other places it occurs as narrow to broad areas on ridgetops. The soil areas have both concave and convex surfaces and cover 2 to 20 acres. This soil has the profile similar to the one described as representative of the series, but the plow layer contains browner subsoil material, because the original surface layer has been partly removed by erosion. The fragipan is nearer the surface, and consequently the root zone is thinner and the available water capacity is less. There are a few sinkholes.

Included with this soil in mapping are areas of slightly eroded Nicholson soils that are mainly in woodland and areas of severely eroded Nicholson soils that are dissected by shallow gullies. In these areas chert and limestone fragments and in some places the upper part of the fragipan are exposed. Also included are areas of Bratton soils that are more sloping and eroded and a few areas of a somewhat poorly drained soil that occurs as narrow bands along and at the head of drainageways.

Erosion is the main limitation to farm use. Depth to bedrock and slow permeability are limitations to nonfarm uses. Capability unit IIe-2; woodland suitability group 2o1.

NnC2—Nicholson silt loam, 6 to 12 percent slopes, moderately eroded. This sloping soil is on the sides of ridges and along minor drainageways. Generally, it has short slopes. It is in long areas that range from 2 to 44 acres, but generally cover 5 to 20 acres. Areas of this soil commonly are adjacent to and upslope from the steeper Opequon soils. This soil has a profile similar to the one described as representative of the series, but the present plow layer contains browner subsoil material because part of the original surface layer has been removed by erosion. Also, the fragipan is nearer the surface, and the available water capacity is slightly less.

Included with this soil in mapping are areas of severely eroded Nicholson soils that are dissected by shallow gullies. In these areas chert and limestone fragments and in some places the upper part of the fragipan is exposed. Also included are areas of a somewhat poorly drained soil that occurs in narrow bands along and at the head of drainageways. Other inclusions are areas of more sloping, eroded Bratton soils and seepy areas that commonly occur adjacent to this soil at the base of slopes.

Slope and erosion are limitations for farm use, particularly in cultivated areas. This soil is better suited to small grains and legume and grass mixtures than to other crops. The mixtures are used for forage and permanent pasture. Depth to bedrock, slow permeability, and slope are severe limitations to some nonfarm uses. Capability unit IIIe–2; woodland suitability group 2o1.

Ockley Series

The Ockley series consists of well-drained, nearly level to sloping soils that formed in loess and glacial outwash underlain by calcareous stratified sand and gravel. These soils are on terraces in glaciated areas of Wisconsin and

Illinoian age. The native vegetation was hardwood forest in which hickory, oak, and sugar maple were dominant.

In a representative profile in a cultivated area, the surface layer is brown silt loam 6 inches thick. The subsurface layer is yellowish-brown and brown silt loam 3 inches thick. The subsoil extends to a depth of 58 inches. The upper 12 inches is yellowish-brown silty clay loam. The next 12 inches is yellowish-brown loam. The next 9 inches is yellowish-brown gravelly loam. The next 10 inches is pale-brown silty clay loam. The lower 6 inches is yellowish-brown silt loam. The substratum, to a depth of 70 inches, is dark yellowish-brown gravelly sandy loam.

The available water capacity is medium in Ockley soils. Permeability is moderate in the surface layer and subsoil and rapid in the underlying sand and gravel. Surface runoff is slow to medium, depending on the slope. The root zone is deep and medium acid to very strongly acid.

Ockley soils are used mainly for corn, soybeans, wheat, and grass-legume mixtures grown for hay and pasture. A small area is in permanent pasture or woodland.

Representative profile of Ockley silt loam, 2 to 6 percent slopes, in a cultivated field, 4 miles east of Rainsboro, 200 feet west of Ross County line, 110 yards south of U.S. Highway 50, 200 yards east of Rocky Fork Creek, and 100 yards east of Cave Road, in Paint Township:

Ap—0 to 6 inches, brown (10YR 4/3) silt loam; weak, fine and medium, subangular blocky structure parting to weak, fine and medium, granular; very friable; common roots; medium acid; abrupt, smooth boundary.

B&A—6 to 9 inches, yellowish-brown (10YR 5/6) and brown (10YR 4/3) silt loam; weak, fine and medium, subangular blocky structure; friable; common roots; dark grayish-brown (10YR 4/2) organic coatings in old root channels; medium acid; clear, wavy boundary.

B1t—9 to 14 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate, fine and medium, subangular blocky structure; friable; few roots; thin, very patchy, dark yellowish-brown (10YR 4/4) clay films on vertical and horizontal ped faces; thin, very patchy silt coatings that are pale brown (10YR 6/3) when moist and light gray (10YR 7/2) when dry on vertical and horizontal ped faces; dark grayish-brown (10YR 4/2) organic coatings in old root channels; strongly acid; clear, wavy boundary.

B21t—14 to 21 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate, fine and medium, subangular blocky structure; friable to firm; few roots; thin, very patchy, dark yellowish-brown (10YR 4/4) clay films on vertical and horizontal ped faces; thin, patchy silt coatings of pale brown (10YR 6/3) when moist and light gray (10YR 7/2) when dry on vertical and horizontal ped faces; 5 percent pebbles; strongly acid; gradual, wavy boundary.

IIB22t—21 to 27 inches, yellowish-brown (10YR 5/6) loam; moderate, fine and medium, subangular blocky structure; friable to firm; few roots; thin clay films that are continuous brown and (7.5YR 4/4) on vertical ped faces and very patchy and brown (7.5YR 4/4) on horizontal ped faces; common, fine, prominent, black (10YR 2/1) stains and concretions; 5 percent pebbles; strongly acid; gradual, wavy boundary.

IIB23t—27 to 33 inches, yellowish-brown (10YR 5/6) loam; moderate, medium, subangular blocky structure; firm; few roots; thin clay films that are continuous brown and (7.5YR 4/4) on vertical ped faces and very patchy brown (7.5YR 4/4) on horizontal ped faces; common, fine, prominent, black (10YR 2/1) stains and concretions; 8 percent pebbles; strongly acid; gradual, wavy boundary.

IIB24t—33 to 42 inches, yellowish-brown (10YR 5/4) gravelly loam; weak, medium, subangular blocky structure; firm; few roots; thin, very patchy brown (7.5YR 4/4) clay films on ped faces; common, fine, prominent, black (10YR 2/1) stains and concretions; 25 percent gravel; strongly acid; clear, smooth boundary.

IIB32—42 to 52 inches, pale-brown (10YR 6/3) silty clay loam; weak, thick, platy, structure; firm; few, fine, prominent, black (10YR 2/1) stains and concretions; neutral; clear, smooth boundary.

IIB33—52 to 58 inches, yellowish-brown (10YR 5/4) silt loam; common, medium, faint, yellowish-brown (10YR 5/6) mottles; moderate, medium platy structure; firm; few, fine, prominent, black (10YR 2/1) stains and concretions; mildly alkaline; abrupt, wavy boundary.

IIC—58 to 70 inches, dark yellowish-brown (10YR 4/4) gravelly sandy loam; single grained; loose; 65 percent gravel; mildly alkaline, calcareous.

The thickness of the solum and the depth to calcareous sand and gravel are 42 to 60 inches. The solum ranges from medium acid to very strongly acid in the surface layer and through the B2 horizon and medium to mildly alkaline in the B3 horizon.

The Ap horizon is dark grayish brown (10YR 4/2), dark brown (10YR 4/3), and brown (10YR 5/3). In undisturbed areas the A1 horizon is very dark grayish brown (10YR 3/2), very dark gray (10YR 3/1), or dark grayish brown (10YR 4/2) and 1 to 3 inches thick. Some profiles have an A2 horizon, but some other profiles have either an A&B horizon or a B&A horizon. The A&B horizon or B&A horizon is 2 to 6 inches thick and is yellowish brown (10YR 5/6), brown (10YR 4/3 and 5/3), and light yellowish brown (10YR 6/4).

The B horizon has a hue of 10YR and 7.5YR, a value of 4 and 5, and a chroma of 3 through 6. It is silty clay loam, loam, clay loam, and sandy clay loam, and the lower part of the B2 horizon and the B3 horizon are gravelly in places. In some profiles silty surface horizons extend to a depth of as much as 24 inches.

The C horizon is brown (10YR 5/3 and 4/3), dark yellowish brown (10YR 4/4), and dark grayish brown (10YR 4/2).

Ockley soils are part of a drainage sequence that includes moderately well drained Thackery soils, somewhat poorly drained Sleeth soils, and very poorly drained, dark-colored Westland soils. Ockley soils contain more sand and gravel and are less acid in the lower part of the solum than Williamsburg soils. They differ from Fox soils in that they are more than 42 inches to sand and gravel. They lack a dark-colored A horizon, which the Wea soils have, and they lack underlying calcareous loam glacial till, which the Kendallville soils have.

OcA—Ockley silt loam, 0 to 2 percent slopes. This nearly level soil is on stream terraces. The soil areas are slightly convex, moderately broad, somewhat irregularly shaped, and elongated. They cover 5 to 30 acres. They commonly are adjacent to or between sloping to steep terrace breaks. Sometimes they are adjacent to or in between the terrace breaks and the breaks to the uplands.

Included with this soil in mapping are areas of Thackery and Sleeth soils in slight depressions at the head of and along drainageways. These soils occur as narrow bands along the drainageways. Also included are a few small areas of soils that have a loam surface layer that in some places contains spots of gravel.

This soil has few limitations for farming. It is well suited to nursery crops, truck farming, and sod production. Rapid permeability in the underlying sand and gravel is a limitation to some nonfarm uses. Capability unit I–1; woodland suitability group 1o1.

OcB—Ockley silt loam, 2 to 6 percent slopes. This gently sloping soil is on stream terraces and adjacent to kames, eskers, and end moraines. The areas are slightly convex, narrow and moderately broad, somewhat irregularly shaped, and elongated. They cover 3 to 15

acres. In the areas of glacial landforms, these soils are closely associated with Fox and Miamian soils. This soil has the profile described as representative of the series.

Included with this soil in mapping are some areas of Ockley soils that have a thicker, finer-textured surface layer, because they receive deposition of soil material from the more sloping surrounding soils. Also included are areas of Fox soils and moderately eroded, sloping Ockley soils that have a surface layer of loam or clay loam that in some places contains spots of gravel. Other inclusions in slight depressions at the head of and along drainageways are areas of Thackery and Sleeth soils. These soils occur as narrow bands along the drainageways.

The hazard of erosion is moderate, and some measures for controlling erosion are needed if the soil is used for crops. This soil is suited to nursery crops, truck farming, and sod production. Slope and rapid permeability of the underlying sand and gravel are limitations to some nonfarm uses. Capability unit IIe-1; woodland suitability group 1o1.

OcC2—Ockley silt loam, 6 to 12 percent slopes, moderately eroded. This sloping soil is on stream terraces and in areas adjacent to kames, eskers, and end moraines. Where they are adjacent to glacial landforms, the soil areas are irregularly shaped, but on the stream terraces they are elongated and somewhat irregularly shaped. They cover 3 to 15 acres. This soil is closely associated with the Fox soils. It has a profile similar to the one described as representative of the series, but the plow layer now consists of browner subsoil material, because part of the original surface layer has been removed by erosion. The plow layer contains many spots of gravel.

Included with this soil in mapping are areas of moderately and severely eroded Fox soils. Also included are some areas of severely eroded Ockley soils that have considerable gravel in the surface layer and are dissected by shallow gullies.

The slope, erosion, and a tendency to droughtiness are limitations to farming uses. Slope and rapid permeability in the underlying sand and gravel are limitations to some nonfarm uses. Capability unit IIIe–1; woodland suitability group 1o1.

OdB—Ockley-Urban land complex, gently sloping. This mapping unit is 35 to 50 percent Urban land, and the rest is mainly Ockley soils. Urban land is soil material that has been altered by cutting and filling. Most areas of this complex are in and near the village of Leesburg, and they are used for urban development. There are areas of unaltered Ockley soils in undeveloped areas, playgrounds, and small tracts of woodland.

Included with this complex in mapping are small undisturbed areas of Thackery and Wea soils. The Thackery soils are less well drained than the soils of this complex.

Urban land consists of altered soil material that is in poor physical condition. The content of organic matter and the available water capacity are reduced. Because the clay content of the surface layer has increased, tilth is reduced, and the tendency of the soil to harden as it dries is increased. Erosion and these soil features that affect the growth of vegetation unfavorably are limitations to some uses. Capability unit and woodland suitability group not assigned.

Opequon Series

The Opequon series consists of well-drained, sloping to very steep soils that formed in thin deposits of loess and residuum weathered from limestone. These soils are on dissected unglaciated uplands. The native vegetation was hardwood forest of mixed oak. At present, redcedar invades unmanaged pasture and abandoned fields.

In a representative profile in a cultivated area, the surface layer is brown silt loam 5 inches thick. The subsoil extends to a depth of 15 inches. The upper 3 inches is yellowish-red heavy silty clay loam. The lower 7 inches is dark reddish-brown clay. The substratum, to a depth of 19 inches, is pale-brown and strong-brown sandy loam. Below a depth of 19 inches is limestone bedrock.

The available water capacity is low in Opequon soils. Permeability is moderate to slow, and surface runoff is moderate to rapid, depending on the slope. The root zone is shallow and commonly medium acid to neutral.

Opequon soils are used mainly for grass-legume mixtures grown for hay and permanent pasture. Corn, wheat, and soybeans are grown in the less eroded sloping areas. A considerable acreage in the steeper areas is in forest, or is idle and reverting to forest.

Representative profile of Opequon silt loam, 6 to 18 percent slopes, moderately eroded, in a cultivated field 2½ miles west of Sinking Spring, 330 yards south of the intersection of Sinking Spring and Cedar Chapel Roads, 330 yards south of Cedar Chapel Church, and 40 feet east of Cedar Chapel Road, in Brush Creek Township:

Ap—0 to 5 inches, brown (10YR 4/3) silt loam; weak, medium, subangular blocky structure; friable; many roots; neutral; abrupt, smooth boundary.

IIB21t—5 to 8 inches, yellowish-red (5YR 4/6) heavy silty clay loam; common, medium, prominent, dark grayish-brown (10YR 4/2) coatings in worm channels; moderate, fine and medium, subangular and angular blocky structure; firm; common roots; common tubular pores; medium, patchy, reddish-brown (5YR 4/3) clay films on somewhat irregularly shaped, rounded vertical and horizontal ped faces; neutral; clear, wavy boundary.

IIB22t—8 to 15 inches, dark reddish-brown (5YR 3/2) clay; moderate, fine and medium, subangular blocky structure parting to strong, very fine and fine, angular blocky; firm; common roots; common vesicular and tubular pores; medium, continuous; dark-brown (7.5YR 4/4) and reddish-brown (5YR 4/3) clay films on somewhat irregularly shaped, rounded vertical and horizontal ped faces; neutral; abrupt, wavy boundary.

IIC—15 to 19 inches, pale-brown (10YR 6/3) and strong-brown (7.5YR 5/6) sandy loam; dark reddish-brown (5YR 3/4) tongues of material from the B horizon make up 15 percent of horizon, these tongues penetrate 1 to 3 inches; massive; very friable; few roots; 5 percent limestone fragments; mildly alkaline; calcareous; abrupt, wavy boundary.

IIR—19 inches, limestone bedrock.

The thickness of the solum and the depth to bedrock are about 12 to 20 inches. The loess mantle is as much as 12 inches thick in places. The solum ranges from medium acid to mildly alkaline but is commonly slightly acid to neutral. The content of limestone fragments ranges from 0 to 35 percent and increases as depth increases.

The Ap horizon is dark brown (10YR 3/3), brown (10YR 4/3 and 5/3), or yellowish brown (10YR 5/4) silt loam, stony silt loam, and where erosion is severe, clay.

The Bt horizon has a hue of 5YR to 7.5YR, a value of 3 through 5, and chroma of 3 through 6. It is heavy silty clay loam, silty clay, or clay 4 to 16 inches thick.

The thin calcareous C horizon is light yellowish brown (10YR 6/4), strong brown (7.5YR 5/6) or pale brown (10YR 6/3). Some profiles have a mantle of glacial till that is moderately fine textured or fine textured and 4 to 10 inches thick.

Opequon soils have a thinner loess cap and are shallower to limestone bedrock than Bratton soils. They lack a dark-colored A horizon, which the Gasconade soils have. Unlike Colyer soils, they formed over limestone bedrock.

OpD2—Opequon silt loam, 6 to 18 percent slopes, moderately eroded. This sloping to moderately steep soil is on valley walls and hillsides adjacent to streams and drainageways dissecting the uplands. In areas of this soil generally are short, parallel convex side slopes that extend along streams and drainageways for several hundred feet. The soil areas range from 2 to 35 acres, but are commonly from 5 to 20 acres. This soil is commonly adjacent to and upslope from the steeper Opequon or Gasconade soils and is closely associated with the Bratton and Nicholson soils. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few areas of severely eroded Opequon soils that have a finer textured surface layer and that are dissected by shallow gullies. In the areas dissected by gullies, fragments of limestone and chert are exposed; in some places limestone bedrock crops out; and during dry seasons, numerous cracks, ⅛ to ½ inch wide, form. Also included are less sloping, less eroded areas of Bratton soils or Milton soils that are deeper to bedrock. Other inclusions are areas of Gasconade soils that are near bedrock outcrops, at the head of and along drainageways, and at the base of slopes. Along the drainageways, these soils occur as narrow bands. Also included are many seep areas at the base of slopes and a considerable number of sinkholes.

The slope, erosion, a shallow rooting zone, and depth to bedrock are severe limitations to farm and nonfarm uses. Capability unit IVe–3; woodland suitability group 3x1.

OpE2—Opequon silt loam, 18 to 25 percent slopes, moderately eroded. This steep soil is on valley walls and hillsides adjacent to streams and drainageways that dissect uplands. Areas of this soil have parallel convex side slopes, 150 to 400 feet long, that extend along streams and drainageways for several hundred feet. Areas range from 2 to 98 acres but generally cover 5 to 25 acres.

Included with this soil in mapping are a few areas of severely eroded Opequon soils where fragments of limestone are exposed and a few outcroppings of limestone bedrock. Also included are areas of Gasconade soils that are near the bedrock outcrops, are at the head of and along drainageways, and are at the base of slopes. Along the drainageways these soils occur as narrow bands. Other inclusions are less sloping, less eroded areas of Bratton or Milton soils and, at the base of slopes, many seep areas.

This soil is not suited to cultivated crops because of the slope and the hazard of erosion. It is suited to permanent vegetation, and considerable acreage remains in woodland. Slope and shallowness to bedrock are limitations to nonfarm uses. Capability unit VIe–2; woodland suitability group 3x1.

OsF2—Opequon stony silt loam, 18 to 35 percent slopes, moderately eroded. This steep to very steep soil is on valley walls and hillsides of the uplands. Areas of this soil have parallel convex side slopes, 150 to 400 feet in length, that extend along streams and drainageways for several hundred feet. They range from 3 to 36 acres, but are generally 5 to 25 acres.

This soil has a profile similar to the one described as representative of the series, but the surface layer contains limestone fragments that range from 3 to 15 inches in length. The content of limestone fragments in this layer varies greatly within short distances and ranges from 20 to more than 50 percent. There are also many outcrops of bedrock. The size of the outcropping ranges from mere exposure to huge protruding blocks.

Included with this soil in mapping are areas of slightly eroded Opequon stony soils, and areas of severely eroded Opequon stony soils that have a finer textured surface layer that is dissected by shallow gullies. In the areas of these severely eroded Opequon soils, blocks and fragments of limestone are exposed; in many places limestone bedrock crops out; and during dry seasons, wide cracks form in the surface layer. Also included are areas of Bratton soils or Milton soils that are less sloping, less eroded, and deeper to bedrock. Other inclusions are small concave areas of Gasconade soils along drainageways and at the base of slopes, numerous seep areas at the base of slopes, and a few, very steep, bedrock escarpments.

This soil is used mainly for pasture or woodland and is suited to permanent vegetation. It has potential for recreation and wildlife habitat. The slope, erosion, depth to bedrock, and stoniness are severe limitations to farm and nonfarm uses. Capability unit VIs–1; woodland suitability group 3x1.

OsG—Opequon stony silt loam, 35 to 50 percent slopes. This very steep soil is on valley walls and hillsides of the uplands. Areas of this soil have parallel, convex side slopes, 150 to 400 feet long, that extend along streams and drainageways for several hundred feet. They range from 3 to 100 acres but are generally 10 to 40 acres.

This soil has a profile similar to the one described as representative of the series, but the surface layer contains limestone fragments ranging from 3 to more than 15 inches in diameter. The content of limestone fragments in the surface varies greatly within short distances and ranges from almost none to more than 65 percent. There are also many outcrops of limestone bedrock. These outcroppings range from mere exposure to huge protruding blocks and ledges. Fragments and blocks are exposed or limestone crops out in about 50 to 75 percent of the soil areas.

Included with this soil in mapping are a few less sloping areas of slightly eroded Bratton or Milton soils that are deeper to bedrock. Also included are a larger number of small concave areas of Gasconade soils along drainageways and at the base of slopes. Other inclusions are many springs, some moderately and severely eroded spots, and some bedrock escarpments.

This soil is not suitable for cultivation. It is suited to permanent vegetation, particularly trees, and is used mostly for woodland. Slope, erosion, depth to bedrock, and stoniness are limitations to nonfarm uses. This soil has a potential for recreation and wildlife habitat. Capability unit VIIs–1; woodland suitability group 3x1.

OtD3—Opequon clay, 6 to 18 percent slopes, severely eroded. This sloping to moderately steep soil is on valley walls and hillsides adjacent to streams and drainageways that dissect the uplands. Areas of this soil generally have

short, convex side slopes that parallel the streams and drainageways for several hundred feet. They range from 2 to 35 acres but are generally 5 to 20 acres. This soil commonly is adjacent to and upslope from the steeper Opequon or Gasconade soils and near the Bratton and Nicholson soils.

This soil has a profile similar to the one described as representative of the series, but the surface layer has a high content of clay because it consists mainly of the browner, finer textured subsoil material. This soil is quite shallow, because it is severely eroded. There are many more bedrock outcrops and more shallow and deep gullies that expose more limestone fragments, chert, and geodes at the surface (fig. 9) than on the less eroded Opequon soils. Because of the clayey surface layer and the slope, this soil is difficult to till. During dry seasons, many cracks that are as much as 1½ inches wide form polygonal designs on the surface. These cracks extend to the underlying bedrock in places.

Included with this soil in mapping, between gullies and at the bottom of slopes, are less eroded areas of Opequon silt loam. Also included are small areas of Bratton or Milton soils and Gasconade soils. Also included are many seep areas at the base of slopes and some sinkholes.

This soil is suitable for the permanent vegetation of pasture or woodland. Slope and erosion are severe limitations both to farm and nonfarm uses. Capability unit IVe–3; woodland suitability group 3x1.

Otwell Series

The Otwell series consists of well-drained, gently sloping to very steep soils that formed in loess and the underlying outwash. They are on dissected lake plains, valley trains, high stream terraces, and kames. The native vegetation was deciduous hardwood forest in which beech, hickory, oak, and maple were dominant.

In a representative profile in a cultivated area, the surface layer is dark grayish-brown silt loam 8 inches thick. The subsurface layer is brown silt loam 6 inches thick. The subsoil extends to a depth of 80 inches. The upper 5 inches is yellowish-brown silt loam. The next 7 inches is brown and dark yellowish-brown silt loam. The next 6 inches is yellowish-brown silty clay loam. The next 11 inches is yellowish-brown, firm, brittle silty clay loam mottled with light gray. The next 12 inches is dark yellowish-brown, firm, brittle loam mottled with light gray. The lower 25 inches is yellowish-brown sandy clay loam mottled with pale brown in the upper part and with a lighter shade of yellowish-brown in the lower part. The substratum, to a depth of 110 inches, is yellowish-brown sandy clay and loam mottled with dark yellowish-brown, gray, and a lighter shade of yellowish-brown.

The available water capacity is medium in Otwell soils. Permeability is very slow, and surface runoff is medium to rapid, depending on the slope. The root zone is moderately deep to deep and medium acid to very strongly acid.

Otwell soils are used mainly for corn, wheat, and soybeans. In the more sloping areas, grass-legume mixtures are grown for hay and pasture and woodland is maintained. Some Otwell soils are idle.

Representative profile of Otwell silt loam, 2 to 6 percent slopes, in a cultivated field, 2½ miles east-northeast of New Market, 1½ miles south of the intersection of Concord Road and Green Road, 200 feet east of Concord Road, and 15 feet south of farm lane, in southeastern Liberty Township:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; many roots; neutral; abrupt, smooth boundary.

A2—8 to 14 inches, brown (10YR 4/3) silt loam; weak, thick platy structure; friable; common roots; medium acid; clear, wavy boundary.

B1—14 to 19 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, subangular blocky structure; friable; common roots; medium acid; clear, wavy boundary.

B21t—19 to 26 inches, brown (10YR 4/3) and dark yellowish-brown (10YR 4/4) silt loam; weak, medium, subangular blocky structure; friable; few roots; thin, very patchy, brown (10YR 4/3) clay films on ped faces; medium acid; clear, wavy boundary.

B22t—26 to 32 inches, yellowish-brown (10YR 5/4) silty clay loam; moderate, medium, subangular blocky structure; friable; few roots; thin, patchy, pale-brown (10YR 6/3) clay films on ped faces; strongly acid; clear, wavy boundary.

IIBx1—32 to 43 inches, yellowish-brown (10YR 5/6) silty clay loam; common, medium, distinct, light-gray (10YR 6/1) mottles; weak, very coarse, prismatic structure parting to moderate, thick, platy; firm and brittle; few roots; thick, continuous, gray (10YR 5/1) clay films on vertical ped faces and medium, patchy, yellowish-brown (10YR 5/4) clay films on horizontal ped faces; 5 percent pebbles; very strongly acid; gradual, wavy boundary.

IIBx2—43 to 55 inches, dark yellowish-brown (10YR 4/4) loam; common, medium, distinct, light-gray (10YR 6/1) mottles; weak, very coarse, prismatic structure parting to moderate, thick and medium, platy; firm and brittle; thick and medium, continuous, gray (10YR 6/1) clay films on vertical ped faces and thin, very patchy, yellowish-brown (10YR 5/4) clay films on horizontal ped faces; 8 percent pebbles; strongly acid; gradual, wavy boundary.

IIB31—55 to 62 inches, yellowish-brown (10YR 5/4) sandy clay loam; weak, medium and coarse, subangular blocky structure; friable; 8 percent pebbles; medium acid; gradual, wavy boundary.

IIB32—62 to 80 inches, yellowish-brown (10YR 5/4) sandy clay loam; weak, medium and coarse, subangular blocky structure; friable; 10 percent pebbles; slightly acid; gradual, wavy boundary.

IIC—80 to 110 inches, yellowish-brown (10YR 5/4) sandy clay loam and loam; common, fine, distinct mottles of dark yellowish brown (10YR 4/4) and gray (10YR 6/1) and few, fine, distinct mottles of yellowish brown (10YR 5/8); massive; friable; 10 percent pebbles; mildly alkaline, calcareous.

The solum is 40 to more than 80 inches thick and the loess is 20 to 40 inches thick. Reaction is very strongly acid to medium acid below the Ap horizon through the lower part of the fragipan, medium acid to slightly acid in the B3 horizon, and neutral to moderately alkaline in the C horizon.

The Ap horizon has a hue of 10YR and 7.5YR, a value of 4 and 5, and a chroma of 2 through 4.

The B horizon, except for the B1 horizon and the C horizon has a hue of 10YR and 7.5YR, a value of 4 through 6, and a chroma of 3 through 8. B2t is silty clay loam, silty loam, or clay loam, and the fragipan is mainly silty clay loam but is silt loam, loam, or clay loam in places. Depth to mottling ranges from 30 to 60 inches. In some profiles, sand and gravel is at a depth of 8 to 12 feet.

Otwell soils are part of the drainage sequence that includes the moderately well drained Haubstadt soils and the somewhat poorly drained Dubois soils. Otwell soils are underlain by outwash, and Cincinnati and Russell soils are underlain by glacial till. They are more acid than Ockley and Williamsburg soils, and they have a fragipan. Unlike Nicholson soils, they are stratified in the lower part of the solum and did not form over bedrock.

OwB—Otwell silt loam, 2 to 6 percent slopes. This gently sloping soil is on convex ridges and on the nose of areas below the main uplands. The soil areas cover 2 to

Figure 9.—Pasture, near Fairfax, on Opequon clay, 6 to 18 percent slopes, severely eroded.

25 acres. This soil has the profile described as representative of the series. The surface layer erodes easily. During periods of high rainfall a perched water table may develop, because permeability of the fragipan is very slow.

Included with this soil in mapping are a few areas of nearly level and gently sloping Haubstadt soils and a few areas of Dubois soils at the head of and along small drainageways.

Erosion is a moderate limitation to farm use and very slow permeability is a limitation to nonfarm uses. This soil is suited to tobacco, because it has good natural drainage and good tilth. Capability unit IIe–1; woodland suitability group 2o1.

OwC2—Otwell silt loam, 6 to 12 percent slopes, moderately eroded. This sloping soil is in narrow areas along streams and on benches above steeper soils. In some places it is in areas that join the flood plain. Areas are 3 to 50 acres. This soil has a profile similar to the one described as representative of the series, but part of the original surface layer has been removed by erosion and the plow layer has been mixed with the subsoil. Also, depth to the fragipan is less. Tilth has been reduced because of the high clay content in the subsoil that has been mixed into the remaining surface layer.

Included with this soil in mapping are a few areas of gently sloping and sloping Haubstadt soils and sloping and moderately steep Negley soils. Also included are a few areas of slightly eroded Otwell soils that are in woodlands, and a severely eroded soil that lacks a fragipan. Severely eroded spots are identified on the soil map by use of the spot symbol for erosion.

Slope and erosion are severe limitations to farm use. Slope and very slow permeability are limitations to nonfarm uses. Capability unit IIIe–1; woodland suitability group 2o1.

OwD2—Otwell silt loam, 12 to 18 percent slopes, moderately eroded. This moderately steep soil is in narrow areas along streams and drainageways and on hillsides above the steeper areas. Areas cover 2 to 38 acres. This soil has a profile similar to the one described as representative of the series, but the plow layer is mixed with part of the subsoil, and the depth to the fragipan is less because part of the original surface layer has been removed by erosion.

Included with this soil in mapping are a few areas of moderately steep and steep Negley soils and a soil similar to Otwell soils, except that it lacks a fragipan. Also included are a few areas of Boston and Bratton soils. In these areas, generally limestone bedrock crops out.

Measures for erosion control are needed if this soil is cultivated. Slope and erosion are severe limitations to farm uses. Slope and very slow permeability are limitations to nonfarm uses. Capability unit IVe–1; woodland suitability group 2r1.

OwE2—Otwell silt loam, 18 to 25 percent slopes, moderately eroded. This steep soil is in narrow areas on valley sides and along streams. The areas cover 2 to 30 acres. This soil has a profile similar to the one described as representative of the series, but the surface layer is thinner and the fragipan is nearer the surface because part of the original surface layer has been removed by erosion.

Included with this soil in mapping are a few areas of Haubstadt soils and moderately steep and steep Negley soils and, upslope from this soil, areas of Loudon soils.

Because of the slope and erosion this soil is not suited to cultivation. It is suited to permanent vegetation, and most areas are now in permanent vegetation. Slope and very slow permeability are severe limitations to nonfarm uses. Capability unit VIe–1; woodland suitability group 2r1.

OwF—Otwell silt loam, 25 to 35 percent slopes. This very steep soil is in narrow areas along streams and drainageways. The areas cover 3 to 42 acres. This soil has a profile similar to the one described as representative of the series, but it is thinner and the fragipan is nearer the surface. The surface layer of this soil is medium to strongly acid in most places, because lime is not commonly added.

Included with this soil in mapping are a few areas of Negley soils, a few areas of Boston and Bratton soils and Hickory soils, which are at the base of slopes. In areas of Boston and Bratton soils, generally, limestone bedrock crops out.

Because of slope and the hazard of erosion, this soil is not suited to cultivation. It is suited to permanent vegetation, but most areas are not in permanent vegetation. Slope and very slow permeability are severe limitations to nonfarm uses. Capability unit VIe–1; woodland suitability group 2r1.

Patton Series

The Patton series consists of very poorly drained, nearly level soils that formed mainly in loess, lacustrine material, and glacial till. They are mainly in depressions of the glacial till plains, but some are on terraces and in lakebeds and did not have a substratum of till. The native vegetation was hardwood forest in which pin oak, swamp white oak, blackgum, elm, and soft maple were dominant.

In a representative profile in a cultivated area, the surface layer is very dark gray silt loam 8 inches thick. From a depth of 8 to 16 inches it is black silty clay loam. The subsoil extends to a depth of 70 inches. The upper 31 inches is gray silty clay loam that has yellowish-brown mottles. The next 8 inches is gray silty clay loam that has strong-brown mottles. The lower 15 inches is gray clay loam that has yellowish-brown mottles. The substratum, to a depth of 88 inches, is mixed gray and strong-brown clay loam, and to a depth of 105 inches it is mixed strong-brown and yellowish-brown clay loam.

The available water capacity is high in Patton soils. Permeability is slow, and surface runoff is slow. These soils have a high water table during winter and spring, and they dry out slowly after rains. The root zone is deep, and is commonly slightly acid to strongly acid. The surface layer of Patton soils has a high content of organic matter.

Patton soils are used mainly for corn, soybeans, wheat, and grass-legume mixture for hay and pasture. A small part is in woodland, and some is idle.

Representative profile of Patton silt loam, till substratum, in a cultivated field, approximately 7 miles west and 6 miles north of Hillsboro, 1¼ miles north of the intersection of Horseshoe Road and State Route 124, and 450 yards west of Horseshoe Road, in Union Township:

Ap—0 to 8 inches, very dark gray (10YR 3/1) silt loam; fine and medium, subangular blocky structure; friable; common roots; neutral, abrupt, smooth boundary.

A12—8 to 16 inches, black (10YR 2/1) silty clay loam, very dark brown (10YR 2/2) crushed; common, fine, distinct, yellowish-brown (10YR 5/8) and dark yellowish-brown (10YR 4/4) mottles; weak, coarse, prismatic structure parting to strong, medium, angular blocky; firm; few roots; medium acid; abrupt, wavy boundary.

IIB21g—16 to 22 inches, gray (10YR 5/1) silty clay loam; many, fine and medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, prismatic structure parting to strong, medium, angular blocky; firm; few roots; many black (10YR 2/1) organic coatings on ped faces; few, fine, faint, very dark brown (10YR 2/2) stains; medium acid; clear, wavy boundary.

IIB22g—22 to 28 inches, gray (10YR 5/1) silty clay loam; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, prismatic structure parting to moderate, medium and coarse, subangular blocky; very firm; few roots; grayish-brown (2.5YR 5/2) krotovinas; many black (10YR /1) organic coatings on ped faces; few, fine, distinct, very dark brown (10YR 2/2) stains; slightly acid; gradual, wavy boundary.

IIB23g—28 to 37 inches, gray (10YR 6/1) silty clay loam; many, medium, distinct, yellowish-brown (10YR 5/6 and 5/8) mottles; weak, coarse, prismatic structure parting to moderate, medium and coarse, angular blocky; firm; few roots; (10YR 5/1) krotovinas; common black (10YR 2/1) organic coatings on ped faces; few, fine, distinct, very dark brown (10YR 2/2) stains; slightly acid; diffuse, wavy boundary.

IIB24g—37 to 47 inches, gray (10YR 5/1) silty clay loam; many, medium and coarse, distinct, yellowish-brown (10YR 5/8) mottles; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; firm; dark-gray (10YR 4/1) and very dark gray (10YR 3/1) krotovinas; slightly acid; gradual, wavy boundary.

IIB25g—47 to 55 inches, gray (N 5/0) silty clay loam; many, medium and coarse, distinct, strong-brown (7.5YR 5/6 and 5/8) mottles; weak; medium and coarse, subangular blocky structure; firm; gray (10YR 5/1) clay krotovinas; slightly acid; gradual, wavy boundary.

IIIB3g—55 to 70 inches, gray (N 5/0) clay loam; many, medium, distinct, yellowish-brown (10YR 5/8) mottles; weak, coarse, subangular blocky structure; friable; slightly acid; diffuse, wavy boundary.

IIIC1—70 to 88 inches, mixed gray (N 5/0) and strong-brown (7.5YR 5/6) clay loam; massive; firm; slightly acid; clear, wavy boundary.

IIIC2—88 to 105 inches, mixed strong-brown (7.5YR 5/8) and yellowish-brown (10YR 5/6) clay loam; massive; firm; mildly alkaline, calcareous.

The solum is typically 65 to 80 inches thick but is 60 to 90 inches in places; the loess mantle is 14 to 40 inches thick. The solum is medium acid to strongly acid in the upper part of the B horizon and medium acid to slightly acid but increasing as depth increases to mildly alkaline in the B3 horizon in some profiles.

The A horizon is very dark grayish brown (10YR 3/2), black (10YR 2/1), very dark gray (10YR 3/1), and very dark brown (10YR 2/2). It is typically 10 to 16 inches thick but is as much as 24 inches in places.

The B2 horizon has a hue of 10YR and 2.5Y, a value of 5 and 6, and a chroma of 1 or less. Mottles are yellowish brown (10YR 5/6 and 5/8) and strong brown (7.5YR 5/6 and 5/8). The B3 horizon is gray (10YR 5/1 and 6/1) or (N 5/0) and dark gray (N 4/0) and mottled with yellowish brown (10YR 5/6 and 5/8) and strong brown (7.5YR 5/6 and 5/8).

These soils have a thicker solum and slower permeability than is defined for the series. This difference does not alter their usefulness and behavior.

The dark-colored Patton soils are part of the drainage sequence that includes well-drained Cincinnati soils, moderately well drained Rossmoyne soils, somewhat poorly drained Avonburg soils, poorly drained Clermont soils, and dark-colored, poorly drained Blanchester soils. Patton soils lack the underlying sand and gravel common to Westland soils. They have a more acid solum than Brookston soils and are underlain by

glacial till of Illionian age rather than of Wisconsin Age. They have a thicker dark-colored A horizon than Blanchester soils.

Pa—Patton silt loam. This soil is in nearly level to depressed terrace areas along streams and drainageways, in lakebed and slack water areas, at the head of drainageways, and commonly adjacent to steep sloping areas and escarpments. The areas are narrow to broad, elongated, and in places irregularly shaped. At the head of drainageways they are fan shaped. The areas cover 5 to 20 acres.

This soil has a profile similar to the one described as representative of the series, but the substratum of till below a depth of 55 inches is lacking. Consequently the substratum has less strength. This soil is subject to seepage and to deposition of soil material from surrounding, more sloping areas. It is also subject to ponding.

Included with this soil in mapping are areas of Westland soils and some small areas of Fitchville soils. Also included are some areas of Patton soils that have a surface layer of silty clay loam and loam.

Wetness is the main limitation to farm use. This soil is suited to most of the crops grown in the county. Very poor natural drainage, a seasonal high water table, and seasonal ponding are severe limitations to many nonfarm uses. Capability unit IIw-4; woodland suitability group 2w1.

Pb—Patton silt loam, till substratum. This nearly level soil is at the head of and along drainageways, and in depressions of the till plain. Areas are adjacent to and in many places surrounded by Blanchester soils. They cover 3 to 50 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas that have a surface layer of silty clay loam and some areas of Blanchester and Clermont soils. Where this soil extends along drainageways, areas of Algiers soils downslope are also included. Other inclusions are some areas where depth to glacial till material is as little as 30 inches and some areas that are underlain by limestone bedrock at a depth ranging from 7 to 15 feet.

The use of surface drains is the common method of removing excess water from this soil. Wetness is the main limitation to farm use. Very poor natural drainage, a seasonally high water table, and slow permeability are severe limitations to nonfarm uses. Capability unit IIw-4; woodland suitability group 2w1.

Peoga Series

The Peoga series consists of poorly drained, nearly level soils that formed in materials of mixed origin, derived from drift and loess of Illinoian age. They are in old lake basins on the till plain. The native vegetation was hardwood forest in which oak, elm, ash, sweetgum, and sycamore were dominant.

In a representative profile in a cultivated area, the surface layer is grayish-brown silt loam 9 inches thick. The subsurface layer, to a depth of 16 inches, is gray silt loam that has yellowish-brown and light yellowish-brown mottles. Below this, to a depth of 24 inches, is gray silt loam that has yellowish-brown mottles. The subsoil extends to a depth of 72 inches. The upper 11 inches is gray silty clay loam that has yellowish-brown mottles. The next 22 inches is gray silty clay loam that has strong-brown mottles. The lower 15 inches is dark-gray silty clay that has dark yellowish-brown and yellowish-brown mottles. The substratum, to a depth of 97 inches, is gray silty clay loam that has light yellowish-brown mottles.

The available water capacity is medium in Peoga soils. Permeability is slow, and surface runoff is slow to very slow. These soils have a high water table during winter and spring, and they dry out slowly after rains. The root zone is deep, and is commonly medium acid to very strongly acid.

Peoga soils are used mainly for corn, soybeans, wheat, and grass-legume mixtures for hay and pasture. A small part is in woodland, and some is idle.

Representative profile of Peoga silt loam, in a cultivated field 1¾ miles southeast of Marshall on State Route 506 and Turkey Road, 0.9 mile south of the intersection of State Route 506 and Turkey Road, 530 yards west of Turkey Road, and 125 yards east of woods, in Marshall Township:

Ap—0 to 9 inches, grayish-brown (10YR 5/2) silt loam; moderate, fine and medium, granular structure; very friable; common roots; medium acid; abrupt, smooth boundary.

A2g—9 to 16 inches, gray (10YR 6/1) silt loam; common, medium, distinct, yellowish-brown (10YR 5/6) and light yellowish-brown (10YR 6/4) mottles; weak, fine and medium, subangular blocky structure; friable; common roots; strongly acid; gradual, wavy boundary.

A&Bg—16 to 24 inches, gray (10YR 6/1) silt loam; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; 70 percent is A2 material, and 30 percent is B1 material; weak to moderate, medium and coarse, subangular blocky structure; friable; few roots; very strongly acid; gradual, wavy boundary.

B1tg—24 to 35 inches, gray (10YR 6/1) silty clay loam; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, fine and medium, subangular blocky structure; friable to firm; few roots; thin, patchy, gray (10YR 6/1) clay films on vertical ped faces and thin, very patchy, gray (10YR 6/1) clay films on horizontal ped faces; thin silt coatings that are light gray (10YR 7/1) when moist and white (10YR 8/1) when dry and that are continuous on vertical ped faces and patchy on horizontal ped faces; very strongly acid; clear, wavy boundary.

B21tg—35 to 57 inches, gray (10YR 6/1) silty clay loam; common, medium, distinct, strong-brown (7.5YR 5/6) mottles; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky; firm; few roots; gray (10YR 5/1) clay films that are medium and continuous on vertical ped faces and thin and patchy on horizontal ped faces; 5 percent pebbles; very strongly acid; gradual, wavy boundary.

B22tg—57 to 72 inches, dark-gray (N 4/0) silty clay; common, medium, distinct, dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/6) mottles; moderate, medium, prismatic structure parting to weak, medium and coarse, subangular blocky; firm; thin, gray (10YR 5/1) clay films that are patchy on vertical ped faces and very patchy on horizontal ped faces; few, fine, distinct, black (10YR 2/1) stains and concretions; 5 percent pebbles; strongly acid; clear, wavy boundary.

Cg—72 to 97 inches, gray (10YR 6/1) silty clay loam; many, medium, distinct, light yellowish-brown (2.5Y 6/4) mottles; massive; firm; medium, patchy, light-gray (N 7/0) clay films on vertical ped faces in upper 12 inches; slightly acid at a depth of 75 inches and neutral at a depth of 90 inches, clear, wavy boundary.

The solum is 48 to 72 inches thick. The solum ranges from medium acid to very strongly acid.

The Ap horizon is grayish brown (10YR 5/2) and (2.5Y 5/2) or dark grayish brown (10YR 4/2) and (2.5Y 4/2). In undisturbed areas the A1 horizon is very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2) and very dark brown (10YR 2/2) and 1 to 6 inches thick. The A2 horizon is 4 to 8 inches thick and

has a matrix color of gray (10YR 6/1 and 5/1) and mottles of yellowish brown (10YR 5/4 and 5/6) and light yellowish brown (10YR 6/4).

The B horizon commonly has matrix colors of gray (10YR 6/1 and 5/1) and (N 5/0) or dark gray (N 4/0) and mottles of yellowish brown (10YR 5/4 and 5/6) or strong brown (7.5YR 5/6). In some places there is a B3 horizon that has comparable colors, but in places the matrix and mottle colors are reversed. The horizon is silt loam to clay.

The C horizon is gray (10YR 5/1 and 6/1) and (N 5/0 and N 6/0) or dark gray (N 4/0).

Peoga soils lack a fragipan, but Dubois soils have one. They are underlain by lacustrine material, but Clermont soils are underlain by glacial till.

Pe—Peoga silt loam. This nearly level soil is in broad areas on terraces where outwash was deposited in slack water. In these areas small circular depressions and shallow waterways are common. This soil is ponded in many places during periods of high rainfall. Areas cover 20 to more than 100 acres.

Included with this soil in mapping are Dubois soils on low rises. Also included are the dark-colored Montgomery soils at the head of small drainageways.

The use of surface drains is the common method of removing excess water. Poor natural drainage is the main limitation to farm use. Poor natural drainage, a seasonally high water table, and slow permeability are limitations to nonfarm uses. Capability unit IIIw–4; woodland suitability group 2w1.

Philo Series

The Philo series consists of moderately well drained, nearly level soils that formed in alluvium derived from sandstone and shale. These soils are on narrow flood plains along streams and on colluvial-alluvial fans in small drainageways. The native vegetation was deciduous hardwood forest of pin oak, soft maple, sycamore, elm, and willow.

In a representative profile in a cultivated area, the surface layer is brown silt loam 8 inches thick. The subsoil extends to a depth of 36 inches. The upper 8 inches is dark yellowish-brown silt loam. The next 12 inches is yellowish-brown loam that has dark yellowish-brown and light brownish-gray mottles. The lower 8 inches is grayish-brown loam that has yellowish-brown mottles. The substratum, to a depth of 60 inches, is grayish-brown, brown, and yellowish-brown sandy clay loam.

The available water capacity is high in Philo soils. Permeability is moderate to moderately slow, and surface runoff is slow to very slow. These soils are subject to flooding. The root zone is moderately deep and is commonly medium acid to very strongly acid.

Philo soils are used mostly for corn, wheat, oats, and tobacco. Areas of frequent flooding are used mainly for grass-legume mixtures for hay and pasture. The remaining areas are mainly in woodland, but a few acres are idle.

Representative profile of Philo silt loam, in a cultivated field, 3 miles south-southwest of Sinking Spring, ¼ mile north of Straight Creek Road and farmstead, 65 yards west of steep wooded slope, and 50 yards east of small stream, in Brush Creek Township:

Ap—0 to 8 inches, brown (10YR 4/3) silt loam; weak, fine and very fine, granular structure; very friable; many roots; medium acid; abrupt, smooth boundary.

B21—8 to 16 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, fine and medium, subangular blocky structure parting to moderate, fine, granular; very friable; common roots; strongly acid; clear, wavy boundary.

B22—16 to 28 inches, yellowish-brown (10YR 5/4) loam; few, medium, faint, dark yellowish-brown (10YR 4/4) mottles and common medium, distinct, light brownish-gray (10YR 6/2) mottles; weak, fine and medium, subangular blocky structure parting to moderate, fine and medium, granular; friable; few roots; few, fine, prominent, black (10YR 2/1) stains and concretions; 8 percent fragments; very strongly acid; gradual, wavy boundary.

B23—28 to 36 inches, grayish-brown (10YR 5/2) loam; common, medium, distinct, yellowish-brown (10YR 5/4 and 5/6) mottles; weak, medium, prominent, black (10YR 2/1) stains and concretions; 15 percent fragments; very strongly acid; clear, wavy boundary.

C—36 to 60 inches, grayish-brown (10YR 5/2), brown (10YR 5/3), and yellowish-brown (10YR 5/4) sandy clay loam; 2 layers of loamy sand at a depth of 38 to 41 inches and 44 to 46 inches; massive; very friable to loose; 15 percent fragments; strongly acid.

The solum is 20 to 40 inches thick. Depth to mottles that have a chroma of 2 or less is 12 to 40 inches. In some profiles, sand and gravel containing a high percentage of sandstone and shale fragments are at a depth of 5 to 8 feet. If the soil has not been limed, the Ap horizon is medium acid to strongly acid and the B and C horizons are strongly acid to very strongly acid.

The Ap horizon is dark grayish brown (10YR 4/2) or brown (10YR 4/3 and 5/3). In undisturbed areas, the A1 horizon is very dark grayish brown (10YR 3/2) or very dark gray (10YR 3/1) and 1 to 3 inches thick.

The B horizon is yellowish brown (10YR 5/4 and 5/6), dark yellowish brown (10YR 4/4), brown (10YR 4/3 and 5/3), and grayish brown (10YR 5/2) and is mottled with colors that have a hue of 10YR, a value of 4 through 6, and a chroma of 1 through 6. This horizon is typically loam, but in places it is silt loam, sandy clay loam, or sandy loam.

Philo soils have a more acid solum than Eel and Genesee soils, and they formed in alluvium derived from sandstone and shale.

Pn—Philo silt loam. This nearly level soil is on flood plains and alluvial fans. Along streams the areas are elongated and cover 2 to 30 acres, but on alluvial fans they cover less than 5 acres.

Included with this soil in mapping are areas that have a surface layer of loam. Also included are some areas of Algiers soils and other somewhat poorly drained soils, as well as some areas of a well-drained soil that formed in alluvium.

This soil is suited to most of the crops commonly grown in the area. If adequately fertilized, limed, and protected from flooding, it is suited to tobacco. Occasional flooding is a hazard, and the control of weeds is a problem in some places. The flooding is a severe limitation to many nonfarm uses. Capability unit IIw–5; woodland suitability group 2w2.

Ross Series

The Ross series consists of well-drained, nearly level soils that formed in alluvium derived from glacial drift. These soils are on flood plains and low terraces. The native vegetation was scattered deciduous woodland of elm, sycamore, ash, and walnut, with prairie grasses.

In a representative profile in a cultivated area, the upper part of the surface layer is very dark gray silt loam 10 inches thick. The lower part of the surface layer is 6 inches of very dark gray silt loam, 8 inches of very dark grayish-brown and dark-brown silt loam. The subsoil to

a depth of 29 inches is brown silt loam. The substratum extends to a depth of 81 inches. The upper 26 inches is brown loam. The next 18 inches is dark yellowish-brown, loose sand and gravel. The lower 8 inches is dark-brown, loose sand and gravel.

The available water capacity is high in Ross soils. Permeability is moderate, and surface runoff is slow. These soils are subject to flooding. The root zone is moderately deep to deep and commonly slightly acid to mildly alkaline. The surface has a high content of organic matter.

Ross soils are used mainly for corn, soybeans, wheat, and tobacco. Where flooding is a hazard, they are used mainly for grass-legume mixtures for hay and pasture. The remaining areas are in woodland, and little or no acreage is idle.

Representative profile of Ross silt loam, in a cultivated field, 3¼ miles east-southeast of Hillsboro, 0.65 mile south-southwest of the Highland County Home, 440 yards south of State Route 124, and 330 feet north of Rocky Fork Creek, in Liberty Township:

Ap—0 to 10 inches, very dark gray (10YR 3/1) silt loam; very dark grayish brown (10YR 3/2) when rubbed; moderate, medium, granular structure; very friable; common roots; common to many vesicular pores; mildly alkaline, calcareous; abrupt, smooth boundary.

A12—10 to 16 inches, very dark gray (10YR 3/1) silt loam; very dark grayish-brown (10YR 3/2) when rubbed; moderate, medium, subangular blocky structure; friable; few roots; common vesicular and tubular pores; mildly alkaline, calcareous; clear, wavy boundary.

A13—16 to 24 inches, 85 percent very dark grayish-brown (10YR 3/2) and 15 percent dark-brown (10YR 4/3) silt loam; weak, medium, subangular blocky structure; friable; few roots; common vesicular and tubular pores; moderately alkaline; clear, irregular boundary.

B—24 to 29 inches, brown (10YR 4/3) silt loam; tongues of very dark grayish-brown (10YR 3/2) silt loam; weak, coarse, subangular blocky structure; firm; few roots; common tubular pores; mildly alkaline; clear, wavy boundary.

C1—29 to 40 inches, brown (10YR 4/3) loam; weak, medium, prismatic structure; friable; common tubular pores; neutral; gradual, wavy boundary.

C2—40 to 55 inches, brown (10YR 4/3) loam; massive; very friable; common tubular pores; mildly alkaline, calcareous; clear, wavy boundary.

C3—55 to 73 inches, dark yellowish-brown (10YR 4/4) sand and gravel; single grained; loose; mildly alklaine, calcareous; gradual, wavy boundary.

C4—73 to 81 inches, dark-brown (7.5YR 4/4) sand and gravel; single grained; loose; mildly alkaline, calcareous.

Reaction from slightly acid to moderately alkaline throughout the profile.

The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2), or dark brown (10YR 3/3).

The A and B horizons combined are 24 to 40 inches thick.

The C horizon has a hue of 10YR and 7.5YR, a value of 4 and 5, and a chroma of 2 through 4. It is commonly silt loam and loam, but in a few places it is light silty clay loam or sandy clay loam. The lower part of the C horizon is loose sand and gravel and, in some profiles, thin strata of sandy loam, loamy sand, or sand and gravel.

Ross soils are commonly adjacent to the well-drained Genesee soils, moderately well drained Eel soils, somewhat poorly drained Shoals soils, and dark-colored very poorly drained Sloan soils. Ross soils have a darker colored A horizon than Genesee soils. Unlike Dana soils, they are underlain by alluvial materials. Ross soils have a thicker dark-colored A horizon than the Wea soils. They lack a well-defined B horizon but the Wea soils have one.

Rn—Ross silt loam. This nearly level soil is on flood plains, more commonly along the larger streams. The areas cover 5 to more than 100 acres.

Included with this soil in mapping are areas that have a surface layer of loam, areas of Stonelick soils, and areas of moderately well drained, dark-colored soil that formed in alluvium. Also included are areas of Algiers and Sloan soils. In some areas the soils have a dark-colored surface layer that is only 18 to 24 inches thick.

This soil is not subject to erosion, but it is subject to flooding. This soil does not ordinarily need liming. It can be used for intensive cropping without loss of soil material. The flooding is a severe limitation to nonfarm uses. Capability unit IIw–5; woodland suitability group 1o1.

Rossmoyne Series

The Rossmoyne series consists of moderately well drained, nearly level to moderately steep soils that formed in loess and the underlying glacial till. These soils are on a glacial till plain that is mantled with loess. The native vegetation was deciduous hardwood forest in which beech, hickory, oak, and maple were dominant.

In a representative profile in a cultivated area, the surface layer is dark grayish-brown silt loam 8 inches thick. The subsurface layer is brown silt loam 4 inches thick. The subsoil extends to a depth of 81 inches. In sequence downward, it is 5 inches of yellowish-brown silt loam that has pale-brown and strong-brown mottles, 6 inches of yellowish-brown silty clay loam that has gray mottles, 14 inches of yellowish-brown, very firm and brittle light clay loam that has gray mottles, 19 inches of yellowish-brown, very firm and brittle loam, and 25 inches of yellowish-brown clay loam. The substratum, to a depth of 97 inches, is yellowish-brown gravelly loam.

The available water capacity is medium in Rossmoyne soils. Permeability is moderately slow to slow, and surface runoff is slow to rapid, depending on slope. The root zone is moderately deep and is commonly very strongly acid.

Rossmoyne soils are used mainly for corn, wheat, soybeans, and grass-legume mixtures for hay and pasture. A moderate acreage is used for pasture and woodland, and a small acreage is idle.

Representative profile of Rossmoyne silt loam, 2 to 6 percent slopes, in a cultivated field 8 miles south of Hillsboro, 450 yards west of the intersection of McAffee and Concord Roads, and 50 yards north of McAffee Road, in Concord Township:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, thick, platy structure; friable; many roots; common tubular pores; medium acid; abrupt, smooth boundary.

A2—8 to 12 inches, brown (10YR 5/3) silt loam; weak, thick, platy structure; friable; many roots; vesicular; common tubular pores; dark grayish-brown (10YR 4/2) krotovinas and worm casts make up 10 percent of the mass; very strongly acid; clear, wavy boundary.

B1—12 to 17 inches, yellowish-brown (10YR 5/4) heavy silt loam; few, medium, faint, pale-brown (10YR 6/3) and strong-brown (7.5YR 5/6) mottles; moderate, fine and medium, subangular blocky structure; friable; common roots; common tubular pores; very strongly acid; clear, wavy boundary.

B2t—17 to 23 inches, yellowish-brown (10YR 5/4) silty clay loam; common, medium, distinct, gray (10YR 6/1) mottles; moderate, medium, subangular blocky structure; firm; common roots; thin, patchy, brown (10YR

4/3) clay films; thin, patchy, light brownish-gray (10YR 6/2) silt coatings on vertical ped faces; very strongly acid; clear, wavy boundary.

IIBx1—23 to 37 inches, yellowish-brown (10YR 5/4) light clay loam; common, fine, distinct, gray (10YR 5/1) mottles; moderate, very coarse, prismatic structure parting to moderate, thick, platy; very firm, brittle; few roots on prism faces; common tubular pores; medium, continuous, dark yellowish-brown (10YR 4/4) clay films inside prisms and gray (10YR 5/1) clay films on prism faces; thick, patchy, pale-brown (10YR 6/3) silty films on prism faces; 5 percent till pebbles; very strongly acid; gradual, wavy boundary.

IIBx2—37 to 56 inches, yellowish-brown (10YR 5/4) loam; weak, very coarse, prismatic structure parting to weak, thick, platy and weak, medium, subangular blocky; very firm, brittle; thick, patchy, gray (N 5/0) and dark grayish-brown (10YR 4/2) clay films on prism faces and in pores; thin, very patchy, dark yellowish-brown (10YR 4/4) clay films inside prisms; thin, patchy, pale-brown (10YR 6/3) silty films on prism faces; common black (10YR 2/1) stains; 5 percent till pebbles; very strongly acid in the upper part and slightly acid in the lower part; clear, wavy boundary.

IIB3t—56 to 81 inches, yellowish-brown (10YR 5/4) clay loam; weak, coarse, subangular blocky structure; firm; few tubular pores; thin, very patchy, dark yellowish-brown (10YR 4/4) clay films; few black (10YR 2/1) stains; 10 percent angular till pebbles; neutral; clear, wavy boundary.

IIC—81 to 97 inches, yellowish-brown (10YR 5/4) gravelly loam; few gray (10YR 6/1) streaks; massive; 25 percent angular till pebbles; calcareous, mildly alkaline.

The thickness of the solum and depth to carbonates range from 60 to 120 inches. The loess mantle is 18 to 40 inches thick. The depth to the fragipan ranges from 18 to 30 inches, and the fragipan is 16 to 40 inches thick. Reaction is very strongly acid or strongly acid from below the Ap horizon into the fragipan and ranges to medium acid or slightly acid in the upper part of the B3 horizon and to neutral in the lower part of the B3 horizon.

The Ap horizon is brown (10YR 5/3), grayish brown (10YR 5/2), or dark grayish brown (10YR 4/2). In unplowed areas the A1 horizon is very dark grayish brown (10YR 3/2). The A2 and B1 horizons, and in places an A&B or B&A horizon, have a hue of 10YR, value of 5, and chroma of 3 through 6.

The B2t and Bx horizons have a hue of 10YR, value of 4 and 5, and chroma of 4 through 6. Silt films that have a hue of 10YR, value of 5 through 7, and chroma of 1 through 3 are in the B2t horizon and fragipan. The B2t horizon is silty clay loam, silt loam, or clay loam. The fragipan is silty clay loam, clay loam, or heavy loam. The IIB3 horizon has a hue of 7.5YR, 10YR, or 2.5Y, value of 4 and 5, and chroma of 3 through 6.

Rossmoyne soils are part of the drainage sequence that includes well-drained Hickory and Cincinnati soils, somewhat poorly drained Avonburg soils, poorly drained Clermont soils, poorly drained, dark-colored Blanchester soils, and very poorly drained, dark-colored Patton soils. Rossmoyne soils differ from Haubstadt, Loudon, Grayford, and Sardinia soils in being underlain by glacial till. They have a fragipan which Xenia soils lack.

RpA—Rossmoyne silt loam, 0 to 2 percent slopes. This nearly level soil is between slopes near the edges of broad, flat areas. Areas are elongated and cover as much as 20 acres.

Included with this soil in mapping are some areas of Avonburg and Cincinnati soils.

Seasonal wetness is a limitation for farming. The soil is suited to tobacco because it is easy to till. Slow to moderately slow permeability and seasonal wetness are limitations for nonfarm uses. Capability unit IIw–3; woodland suitability group 2o1.

RpB—Rossmoyne silt loam, 2 to 6 percent slopes. This gently sloping soil is in broad areas between drainageways and on convex ridgetops and slope noses above and adjacent to steeper soils. In some places it surrounds flat areas of wetter soils. Areas range from 2 to more than 100 acres.

This soil has the profile described as representative of the series. The surface layer is easily eroded. During periods of heavy rainfall, a perched water table develops because the fragipan restricts permeability.

Included with this soil in mapping are Avonburg soils and spots of poorly drained soils in small drainageways. Some areas of more sloping Cincinnati soils and some areas of Boston-Grayford complexes, mostly along waterways, are also included.

The hazard of erosion, restricted permeability, and depth of the rooting zone are limitations for farming. Some areas of this soil are suited to tobacco. Slow to moderately slow permeability and seasonal wetness are limitations for nonfarm uses. Capability unit IIe–2; woodland suitability group 2o1.

RpB2—Rossmoyne silt loam, 2 to 6 percent slopes, moderately eroded. This gently sloping soil is near small drainageways and on ridgetops and slope noses above and adjacent to steeper soils. Areas are elongated and cover 5 to 60 acres.

This soil has a profile similar to the one described as representative of the series, but part of the original surface layer has been removed by erosion, and the present plow layer includes part of the subsoil, is browner, and is finer textured. The fragipan is nearer the surface so the root zone is thinner and the available water capacity is lower. Because the soil is eroded, it is droughty during dry periods. During periods of heavy rainfall, a perched water table develops because the fragipan restricts permeability.

Included with this soil in mapping are Avonburg soils and areas of poorly drained soils in small drainageways. More sloping Cincinnati soils and some areas of Boston-Bratton complexes are also included.

Erosion and restricted permeability are limitations for farming. Slow to moderately slow permeability and seasonal wetness are limitations for many nonfarm uses. Capability unit IIe–2; woodland suitability group 2o1.

RpC2—Rossmoyne silt loam, 6 to 12 percent slopes, moderately eroded. This sloping soil is mostly along drainageways and in narrow strips adjacent to and above steeper soils. In some places it is on ridgetops. Areas cover 2 to 65 acres.

This soil has a profile similar to the one described as representative of the series, but part of the original surface layer has been removed by erosion, and the present plow layer includes part of the subsoil and is browner and finer textured. The fragipan is nearer the surface.

Included with this soil in mapping are areas of slightly eroded Rossmoyne soils in permanent pasture and wooded areas and gently sloping, sloping, and moderately steep Cincinnati soils. Some small areas of Boston-Bratton complexes are also included.

Slope and erosion are limitations for farming. Because it is eroded, this soil is difficult to till and tends to be droughty in dry periods. Slow to moderately slow permeability and slope are limitations for nonfarm uses. Capability unit IIIe–2; woodland suitability group 2o1.

RpD2—Rossmoyne silt loam, 12 to 18 percent slopes, moderately eroded. This moderately steep soil is along

streams and in narrow strips above steeper soils. Areas cover 2 to 15 acres. This soil has a profile similar to the one described as representative of the series, but erosion has removed part of the original surface layer and plowing has mixed subsoil material into the plow layer. The fragipan is nearer the surface, the available water capacity is lower, and tilth is poorer.

Included with this soil in mapping are sloping to steep, well-drained Cincinnati soils and Boston-Bratton complexes that have limestone residuum in the lower part of the subsoil. Also included are areas of soils that lack a fragipan and are less than 45 inches deep to carbonates.

Slope and erosion are limitations for farming. Slow permeability in the fragipan and slope are limitations for many nonfarm uses. Capability unit IVe-2; woodland suitability group 2r1.

RsC3—Rossmoyne silty clay loam, 6 to 12 percent slopes, severely eroded. This sloping soil is along streams and in narrow strips adjacent to and above steeper soils. Areas cover 2 to 15 acres. This soil has a profile similar to the one described as representative of the series, but most of the original surface layer has been removed by erosion and the plow layer is mostly subsoil material. The fragipan is considerably nearer the surface. Because it is eroded, this soil is shallow, droughty, and difficult to till.

Included with this soil in mapping are moderately steep, severely eroded Rossmoyne soils and small areas of Hickory soils. In some places Boston-Bratton complexes are included. Most of these areas have limestone outcrops.

Slope and erosion are severe limitations for farming (fig. 10). Slope, erosion, and restricted permeability are limitations for nonfarm uses. Capability unit IVe-2; woodland suitability group 2o1.

RtB—Rossmoyne-Urban land complex, gently sloping. This mapping unit is 30 to 50 percent disturbed soil material, and the rest is mainly Rossmoyne soils. Most areas are used for urban and industrial development. The altered soil material is in areas where cutting and filling have changed the original soil so that the profile cannot be recognized. The undisturbed Rossmoyne soils are in undeveloped lots, back parts of developed lots, playgrounds, and small tracts of woodland.

Included in mapping in the undisturbed areas are more sloping Rossmoyne soils, Cincinnati soils, and Boston-Grayford complexes.

The disturbed areas of this complex are in poor physical condition. The content of organic matter and available water capacity are reduced. The clay content of the surface layer is increased, which makes tilth poorer and increases the tendency of the soil to harden upon drying. The fragipan layer is difficult to excavate when the soil is dry.

These unfavorable conditions and a hazard of erosion are limitations for plants and construction. Capability unit and woodland suitability group not assigned.

Russell Series

The Russell series consists of well-drained, gently sloping to sloping soils that formed in loess and the underlying glacial till. These soils are on uplands. The native vegetation was hardwood forest in which sugar maple, beech, oak, and hickory were dominant.

Figure 10.—Severely eroded area that is a source of sediment. The soil is Rossmoyne silty clay loam, 6 to 12 percent slopes, severely eroded.

In a representative profile in a cultivated area, the surface layer is brown silt loam 8 inches thick. The subsurface layer is yellowish-brown silt loam 3 inches thick. The subsoil extends to a depth of 61 inches. The upper 6 inches is yellowish-brown silt loam. The next 9 inches is yellowish-brown silty clay loam. The next 18 inches is yellowish-brown silt loam. The lower 17 inches is brown loam. The substratum, to a depth of 82 inches, is yellowish-brown loam.

The available water capacity is high in Russell soils. Permeability is moderate, and surface runoff is slow to medium. The root zone is deep and is commonly medium acid to strongly acid.

Russell soils are used mainly for corn, wheat, grass-legume mixtures for hay and pasture, and soybeans. A small acreage is used for permanent pasture and woodland.

Representative profile of Russell silt loam, 2 to 6 percent slopes, in a cultivated field 1⅛ miles east of Boston on U.S. Highway 50, 330 yards south of U.S. Highway 50 on North Beach Road, 300 feet west of North Beach Road, in Paint Township:

Ap—0 to 8 inches, brown (10YR 5/3) silt loam; moderate, fine and medium, granular structure; very friable; many roots; neutral; abrupt, smooth boundary.

A2—8 to 11 inches, yellowish-brown (10YR 5/4) silt loam; moderate, medium, platy structure; very friable; common roots; common vesicular pores; common, grayish-brown, (10YR 5/2) tubular pores; neutral; clear; wavy boundary.

B1t—11 to 17 inches, yellowish-brown (10YR 5/6) silt loam; moderate, fine and medium, subangular blocky structure; friable; common roots; thin, very patchy, brown (7.5YR 4/4) clay films on ped faces; common, fine, distinct, very dark brown (10YR 2/2) stains and concretions; slightly acid; clear, wavy boundary.

B21t—17 to 26 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; firm; few roots; medium, patchy, brown (7.5YR 4/4) clay films on ped faces; common, fine, distinct, very dark brown (10YR 2/2) stains and concretions; strongly acid; clear, wavy boundary.

IIB22t—26 to 44 inches, yellowish-brown (10YR 5/4) silt loam; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; firm; few roots; medium, patchy, brown (7.5YR 4/4) clay films on vertical ped faces and medium, very patchy, brown (7.5YR 4/4) clay films on horizontal ped faces; thin, very patchy, pale-brown (10YR 6/3) silt coatings on vertical ped faces; common, fine, distinct, very dark brown (10YR 2/2) stains and concretions; 8 percent pebbles; medium acid; gradual, wavy boundary.

IIB3—44 to 61 inches, brown (10YR 4/3) loam; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, coarse, subangular blocky structure; friable; common, fine and medium, very dark brown (10YR 2/2) stains; 8 percent pebbles; slightly acid; clear, wavy boundary.

IIC1—61 to 75 inches, yellowish-brown (10YR 5/4) loam; massive; friable; common, fine and medium, distinct, very dark brown (10YR 2/2) stains; 15 percent pebbles; mildly alkaline, calcareous; gradual, wavy boundary.

IIC2—75 to 82 inches, yellowish-brown (10YR 5/4) loam; massive; firm; common, fine and medium, distinct, very dark brown (10YR 2/2) stains; 15 percent pebbles; mildly alkaline, calcareous.

The thickness of the solum and the depth to calcareous glacial till range from 40 to 70 inches but are commonly 48 to 62 inches. The loess mantle is 22 to 40 inches thick.

The Ap horizon is dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), brown (10YR 5/3), and yellowish brown (10YR 5/4). It is medium acid or strongly acid unless it has been limed. The A2 and B1t horizons have a hue of 10YR, value of 5, and chroma of 4 or 6.

The B1t and B2t horizons are generally silty clay loam, but in places they are silt loam and clay loam. They are 25 to 42 inches thick. Unless they are limed, the B1t and B2t horizons are very strongly acid to medium acid and become less acid as depth increases. The B2t and B3 horizons have a hue of 10YR and 7.5YR, value of 4 or 5, and chroma of 3 through 8. The B3 horizon is loam or clay loam, and it is slightly acid to neutral.

The C horizon is commonly yellowish brown (10YR 5/4) or brown (10YR 4/3). It is loam or clay loam.

Russell soils are part of the drainage sequence that includes moderately well drained Xenia soils, somewhat poorly drained Fincastle soils, and very poorly drained, dark-colored Brookston soils. They are adjacent to well-drained Hennepin and Miamian soils. Russell soils lack the fragipan of Cincinnati soils, and they lack the underlying limestone residuum of Grayford soils. They have a thicker loess mantle and are deeper to calcareous glacial till than Miamian soils, and they lack the gravelly B horizon of Kendallville soils.

RuB—Russell silt loam, 2 to 6 percent slopes. This gently sloping soil is in broad to narrow areas along minor drainageways and on narrow ridgetops in the dissected uplands. Some of the broad areas of this soil extend more than one-quarter mile. Areas on ridgetops are 105 to 500 feet wide and one-quarter to three-quarters of a mile long. The areas cover 5 to 25 acres. Along the drainageways, slopes are convex and are generally 160 to 400 feet long.

Included with this soil in mapping are less sloping Xenia soils in slightly concave areas. Fincastle soils and dark-colored Brookston soils are included at the head of drainageways and in narrow strips along minor drainageways. A few moderately eroded areas of Russell soils are also included.

A moderate hazard of erosion is the main limitation for farming. This soil has few limitations for nonfarm uses. Capability unit IIe–1; woodland suitability group 1o1.

Sardinia Series

The Sardinia series consists of moderately well drained, nearly level to sloping soils. These soils formed in loess or alluvium and in stratified outwash material and alluvium. They are on stream terraces and valley trains in Illinoian glaciated areas. Nearby streams begin in areas of late Wisconsin age glacial material. The native vegetation was hardwood forest in which maple, oak, beech, and hickory were dominant.

In a representative profile in a cultivated area, the surface layer is dark grayish-brown silt loam 9 inches thick. The subsoil extends to a depth of 71 inches. The upper 7 inches is brown silty clay loam. The next 6 inches is yellowish-brown silty clay loam that has light brownish-gray mottles. The next 33 inches is yellowish-brown silt loam that has light brownish-gray mottles. The lower 16 inches is yellowish-brown and grayish-brown loam that has light brownish-gray and yellowish-brown mottles. The substratum, to a depth of 85 inches, is yellowish-brown and grayish-brown gravelly sandy clay loam.

The available water capacity is medium in Sardina soils. Permeability is moderate, and surface runoff is slow to medium. The root zone is moderately deep and is commonly medium acid or strongly acid.

Sardinia soils are used mainly for corn, soybeans, wheat, and grass-legume mixtures for hay and pasture. A small acreage is in permanent pasture or woodland.

Representative profile of Sardinia silt loam, 0 to 2 percent slopes, in a cultivated field 3 miles northeast of Hillsboro, ¼ mile north of the intersection of State Route 138 and Selph Road, and 65 yards west of Selph Road, in Liberty Township:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; friable; common roots; 2 percent rounded pebbles; medium acid; abrupt, smooth boundary.

B1t—9 to 16 inches, brown (10YR 4/3) light silty clay loam; moderate, fine and medium, subangular blocky structure; firm; few roots; 5 percent tubular pores; brown (10YR 5/3) and pale-brown (10YR 6/3) silty coatings; thin, patchy, dark yellowish-brown (10YR 4/4) clay films; 2 percent rounded pebbles; medium acid; clear, wavy boundary.

IIB21t—16 to 22 inches, yellowish-brown (10YR 5/4) light silty clay loam; few, fine, faint, light brownish-gray (10YR 6/2) mottles; moderate, medium, subangular blocky structure; firm; few roots; medium, continuous, brown (7.5YR 4/4) clay films; 2 percent rounded pebbles; strongly acid; clear, wavy boundary.

IIB22t—22 to 32 inches, yellowish-brown (10YR 5/4) silt loam; common, medium, distinct, light brownish-gray (10YR 6/2) mottles; weak, medium, prismatic structure parting to moderate, medium, subangular blocky; firm; few roots; medium, patchy, brown (7.5YR 4/4) clay films; thin, patchy, pale-brown (10YR 6/3) silt coatings on vertical ped faces; 2 percent rounded pebbles; very strongly acid; clear, wavy boundary.

IIB23t—32 to 42 inches, yellowish-brown (10YR 5/4) silt loam; many, medium, distinct, light brownish-gray (10YR 6/2) mottles; weak, coarse, prismatic structure parting to moderate, medium, platy; firm and slightly brittle; few roots on vertical ped faces; medium, patchy, brown (10YR 5/3) clay films on vertical ped faces; common, medium, prominent, very dark brown (10YR 2/2) stains and concretions; 5 percent rounded pebbles; very strongly acid; diffuse, smooth boundary.

IIB24t—42 to 55 inches, yellowish-brown (10YR 5/4) silt loam; many, medium, distinct, light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/8) mottles; weak, coarse, prismatic structure parting to moderate, medium, platy; firm and slightly brittle; medium, patchy, brown (10YR 4/3) clay films on vertical ped faces; common, medium, prominent, very dark brown (10YR 2/2) stains and concretions; 10 percent rounded pebbles; medium acid; clear, wavy boundary.

IIB31—55 to 62 inches, yellowish-brown (10YR 5/4) loam; common, medium, distinct, light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/8) mottles; weak, thick, platy structure; friable; 10 percent rounded pebbles; slightly acid; clear, wavy boundary.

IIB32—62 to 71 inches, grayish-brown (10YR 5/2) loam; many, medium, distinct, yellowish-brown (10YR 5/4 and 5/8) mottles; moderate, medium, platy structure; friable; 10 percent rounded pebbles; slightly acid; abrupt, wavy boundary.

IIIC1—71 to 78 inches, yellowish-brown (10YR 5/4 and 5/8) and grayish-brown (10YR 5/2) gravelly sandy clay loam; massive; friable; 25 percent rounded pebbles; neutral; clear, wavy boundary.

IIIC2—78 to 85 inches, yellowish-brown (10YR 5/4 and 5/8) and grayish-brown (10YR 5/2) gravelly sandy clay loam; massive; friable; 25 percent rounded gravel; mildly alkaline, calcareous.

The solum is 60 to 90 inches thick, and the loess mantle or loamy alluvium is 12 to 30 inches thick. Unless the soil is limed, the solum ranges from medium acid to very strongly acid to a depth of 40 inches and gradually becomes less acid as depth increases. The lower part of the solum is medium acid to neutral.

The Ap horizon is dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), or brown (10YR 4/3 and 5/3). Profiles in undisturbed areas have a very dark grayish-brown (10YR 3/2) and very dark brown (10YR 2/2) A1 horizon 2 to 4 inches thick. They also have an A2 horizon that is yellowish brown (10YR 5/4), light yellowish-brown (10YR 6/4), or brown (10YR 5/3 and 4/3) and is 3 to 6 inches thick.

The B1 and B2 horizons commonly have a hue of 10YR and 7.5YR, value of 4 and 5, and chroma of 4 to 6. The B1t horizon is silt loam or silty clay loam, and the upper part of the B2t horizon is silty clay loam, clay loam, silt loam, or loam. Clay films are thin or medium, patchy or continuous, and have hue of 10YR and 7.5YR, value of 3 to 5, and chroma of 3 to 6. Gray (10YR 6/1) and light brownish-gray (10YR 6/2) mottles are in the upper 10 inches of the B2t horizon. Silt coatings on ped faces in the B2t horizon are pale brown (10YR 6/3) or light yellowish brown (10YR 6/4) when moist and light gray (10YR 7/1 and 7/2) when dry. The lower part of the B2t horizon is clay loam, silty clay loam, sandy clay loam, silt loam, and loam. It is 2 to 35 percent rounded pebbles.

The B3 horizon has a hue of 10YR or 7.5YR, value of 4 and 5, and chroma of 2 to 6. It is clay loam, sandy clay loam, or loam and is gravelly in some places. It is 10 to 35 percent rounded pebbles.

The C horizon is stratified clay loam, sandy clay loam, loam, and gravelly phases of these textures. It is 10 to 35 percent rounded pebbles. Calcareous sand and gravel are at a depth of 7 to 10 feet in some places.

Sardinia soils are part of the drainage sequence that includes well-drained Williamsburg soils, somewhat poorly drained Fitchville soils, and very poorly drained, dark-colored Patton soils Sardinia soils lack the fragipan of Haubstadt soils, and they lack the underlying glacial till of Rossmoyne soils. Their solum is more acid than that of Eel soils.

SaA—Sardinia silt loam, 0 to 2 percent slopes. This nearly level soil is on slightly convex terraces and valley trains. Areas are narrow to moderately broad and somewhat irregularly shaped. They cover 3 to 20 acres. This soil is commonly adjacent to or associated with Ockley, Fox, and Genesee soils. It has the profile described as representative of the series.

Included with this soil in mapping are a few areas of Fitchville soils and dark-colored Westland soils. Some small areas of soils that have a loam surface layer are also included.

This soil receives much runoff and deposits of silty soil material from more sloping soils. The runoff causes ponding and wetness. Wet spots need to be drained, but this soil has few other limitations for farming. It is suited to nursery crops, truck crops, and sod production. Wetness and a seasonal high water table are limitations for some nonfarm uses. Capability unit IIw–3; woodland suitability group 2o1.

SaB—Sardinia silt loam, 2 to 6 percent slopes. This gently sloping soil is mostly in long narrow bands on stream terraces. It is also in narrow to moderately broad, long and irregularly shaped areas on convex terraces and valley trains. Areas cover 3 to 20 acres. This soil is commonly adjacent to or associated with Genesee, Fox, and Ockley soils.

Included with this soil in mapping are a few areas of Fitchville soils. Dark-colored Westland soils are included in narrow bands along drainageways or in slight depressions at the head of drainageways. A few areas of moderately eroded Sardinia soils and more sloping Williamsburg soils are also included.

The hazard of erosion is moderate, and some measures for controlling erosion are needed if this soil is used for crops. The soil is suited to nursery crops, truck crops, and sod production. Slope and a seasonal high water table are limitations for some nonfarm uses. Capability unit IIe–2; woodland suitability group 2o1.

SaC2—Sardinia silt loam, 6 to 12 percent slopes, moderately eroded. This sloping soil is on stream terraces. Areas are narrow, short, and irregularly shaped, and they

cover 3 to 15 acres. This soil is commonly adjacent to or associated with Ockley, Fox, and Genesee soils. It has a profile similar to the one described as representative of the series, but its surface layer contains subsoil material and is browner.

Included with this soil in mapping are a few areas of Fitchville soils. Dark-colored Westland soils are included in narrow bands along drainageways or in slight depressions at the head of drainageways. Small areas of severely eroded Sardinia soils that contain some shallow gullies and some areas of Williamsburg soils are also included.

Slope and erosion are limitations for farming, and some measures for controlling erosion are needed, especially if this soil is used for cultivated crops. Slope is a limitation for many nonfarm uses. Capability unit IIIe–2; woodland suitability group 2o1.

Shoals Series

The Shoal series consists of somewhat poorly drained, nearly level soils. These soils formed in alluvium washed from soils that formed in calcareous glacial till of Wisconsin age. They are on flood plains. The native vegetation was water-tolerant hardwood forest in which elm, cottonwood, poplar, pin and swamp oaks, sycamore, and soft maple were dominant.

In a representative profile in a cultivated area, the surface layer is dark grayish-brown silt loam 6 inches thick. The subsoil extends to a depth of 40 inches. The upper 6 inches is dark grayish-brown silt loam that has grayish-brown and yellowish-brown mottles. The next 9 inches is dark grayish-brown loam that has gray and dark yellowish-brown mottles. The next 13 inches is brown loam that has gray and yellowish-brown mottles. The lower 6 inches is grayish-brown sandy loam that has gray and dark yellowish-brown mottles. The substratum extends to a depth of 62 inches or more. It is dark-gray silt loam that has brown mottles in the upper part and dark-gray loam that has light brownish-gray mottles in the lower part. Below a depth of 62 inches is light olive-brown and dark-gray, loose sand and gravel.

The available water capacity is high in Shoals soils. Permeability is moderate, and surface runoff is very slow. These soils are subject to periodic flooding and they dry out slowly after rain. The root zone is moderately deep to deep and is commonly neutral or mildly alkaline.

Shoals soils are used mostly for corn, soybeans, and small grains. Where flooding is more frequent, they are commonly used for grass-legume mixtures for hay and pasture and woodlands. A moderate acreage is idle and is reverting to forest.

Representative profile of Shoals silt loam, in a cultivated field 1¾ miles southwest of Hillsboro on State Route 138, ½ mile south-southeast of U.S. Highway 62 on farm lane, 220 yards east of farm lane, and 110 yards east of Rocky Fork Creek, in Liberty Township:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; very friable; many roots; neutral; abrupt, smooth boundary.

B1g—6 to 12 inches, dark grayish-brown (10YR 4/2) silt loam; common, medium, distinct, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/6) mottles; weak, fine and medium, subangular blocky structure; friable; common roots; few, fine, distinct, very dark brown (10YR 2/2) stains; neutral; gradual, wavy boundary.

B21g—12 to 21 inches, dark grayish-brown (10YR 4/2) loam; common, medium, distinct, gray (10YR 5/1) and dark yellowish-brown (10YR 4/4) mottles; weak, medium, prismatic structure parting to weak, medium, subangular blocky; friable; common roots; common, fine, distinct, very dark brown (10YR 2/2) stains; neutral; clear, wavy boundary.

B22g—21 to 34 inches, brown (10YR 5/3) loam; common, medium, distinct, gray (10YR 5/1) and yellowish-brown (10YR 5/6) mottles; weak, medium and coarse, subangular blocky structure; friable; common roots; many, fine and medium, distinct, black (10YR 2/1) stains and concretions; neutral; clear, wavy boundary.

B23g—34 to 40 inches, grayish-brown (10YR 5/2) sandy loam; many, medium, distinct, gray (10YR 5/1) and dark yellowish-brown (10YR 4/4) mottles; weak, thick, platy structure; very friable; few roots; many, medium, distinct, black (10YR 2/1) stains and concretions; mildly alkaline; abrupt, smooth boundary.

C1g—40 to 46 inches, dark-gray (5Y 4/1) silt loam, many, medium, distinct, brown (7.5YR 4/4) mottles; massive; very friable; few roots; mildly alkaline, calcareous; gradual, wavy boundary.

C2g—46 to 62 inches, dark-gray (5Y 4/1) loam; common-medium, distinct, light brownish-gray (2.5Y 6/2) mottles; massive; very friable; 10 percent pebbles; mildly alkaline, calcareous; abrupt, wavy boundary.

C3—62 inches, light olive-brown (2.5Y 5/4) and dark-gray (5Y 4/1) sand and gravel; single grained; loose; mildly alkaline, calcareous.

The solum is 24 to 40 inches thick. Reaction in the solum ranges from slightly acid to moderately alkaline but is commonly neutral or mildly alkaline.

The Ap horizon is dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), or dark brown (10YR 4/3). Profiles in undisturbed areas have an A1 horizon that is very dark gray (10YR 3/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2) and is 2 to 6 inches thick.

The B horizon is grayish brown (10YR 5/2), dark grayish brown (10YR 4/2), or brown (10YR 5/3). It contains mottles throughout that have a hue of 10YR, value of 4 through 6, and chroma of 1 through 6. The B horizon is mainly silt loam or loam, but in places it is silty clay loam, clay loam, or sandy loam.

The C horizon is dark gray (10YR 4/1 and 5Y 4/1), grayish brown (10YR 5/2), or light brownish gray (10YR 6/2). It contains mottles that have a hue of 10YR and 2.5Y, value of 4 through 6, and chroma of 1 through 6. It is mainly silt loam or loam, but in places it is silty clay loam, clay loam, or sandy clay loam. In most places the lower part of the C horizon is highly stratified with layers of clay loam, silty clay loam, sandy loam, and loamy sand. Sand and gravel are at a depth of 5 to 8 feet in many places.

Shoals soils are part of the drainage sequence that includes well drained Stonelick and Genesee soils, moderately well drained Eel soils, and very poorly drained, dark-colored Sloan soils. Shoals soils are grayer and more mottled than Stonelick, Genesee, and Eel soils. They lack the dark-colored A horizon of Sloan soils, and they lack the dark-colored, very poorly drained buried soil of Algiers soils.

Sh—Shoals silt loam. This nearly level soil is on flood plains along streams and drainageways. Along large streams, the soil is also in depressions at the base of sloping soils. Areas range from 2 acres in the depressions to more than 100 acres along the streams. Slopes are 0 to 2 percent.

Included with this soil in mapping are dark-colored Sloan soils and Algiers soils. Also included are soils that have a surface layer of loam or sandy loam.

This soil is subject to flash flooding, particularly along small streams. Because it formed in alluvium that has a high content of lime, additional lime is generally not needed for crops. A seasonal high water table and flooding

are the main limitations for farming and are severe limitations for many nonfarm uses. Capability unit IIw–1; woodland suitability group 2w1.

Sleeth Series

The Sleeth series consists of somewhat poorly drained, nearly level soils that formed in loess or alluvium outwash material underlain by calcareous sand and gravel. These soils are on stream terraces in the Wisconsin and Illinoian glaciated areas. The native vegetation was hardwood forest in which elm, sycamore, oak, ash, and maple were dominant.

In a representative profile in a cultivated area, the surface layer is dark grayish-brown silt loam 11 inches thick. The subsurface layer, to a depth of 15 inches, is yellowish-brown silt loam that has gray mottles. The subsoil extends to a depth of 54 inches. The upper 5 inches is yellowish-brown silty clay loam that has gray mottles. The next 7 inches is yellowish-brown silty clay loam that has light brownish-gray and yellowish-brown mottles. The next 9 inches is grayish-brown silty clay loam that has yellowish-brown and brown mottles. The next 7 inches is gray silty clay that has brown and strong-brown mottles. The lower 11 inches is brown gravelly clay that has yellowish-brown and gray mottles. The substratum is brown, brownish-yellow, light yellowish-brown, and light brownish-gray gravelly loam to a depth of 60 inches and is dark-gray loose gravel and sand to a depth of 63 inches.

The available water capacity is high in Sleeth soils. Permeability is moderate in the subsoil and rapid in the substratum. Surface runoff is slow. These soils have a high water table in winter and spring, and they dry out slowly after rain. The root zone is deep and is commonly medium acid or strongly acid.

Sleeth soils are used mainly for corn, soybeans, wheat, and grass-legume mixtures for hay and pasture. A small acreage is in woodland or permanent pasture.

Representative profile of Sleeth silt loam, 0 to 2 percent slopes, in a cultivated field 3¾ miles east of Hillsboro on U.S. Highway 50, ⅜ mile north on Petersburg Road, ⅛ mile west on Carroll Lane, and 330 yards north of Carroll Lane, in Liberty Township:

Ap—0 to 11 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine, granular structure; very friable; many roots; medium acid; abrupt, smooth boundary.

A2—11 to 15 inches, yellowish-brown (10YR 5/4) silt loam; common, fine, distinct, gray (10YR 5/1) mottles; weak, medium, subangular blocky structure; friable; common roots; thin, continuous, pale-brown (10YR 6/3) silt coatings, light gray (10YR 7/2) when dry, on ped faces; dark grayish-brown (10YR 4/2) and grayish-brown (10YR 5/2) stained tongues and isolated pockets; medium acid; clear, wavy boundary.

B1t—15 to 20 inches, yellowish-brown (10YR 5/4) silty clay loam; common, fine, distinct, gray (10YR 5/1) mottles; moderate, fine and medium, subangular blocky structure; firm, common roots; thin, patchy, brown (10YR 4/3) clay films on ped faces; thin patchy, pale-brown (10YR 6/3) silt coatings, light gray (10YR 7/2) when dry, on vertical and horizontal ped faces; few, fine, prominent, black (10YR 2/1) stains and concretions; slightly acid; abrupt, wavy boundary.

B21t—20 to 27 inches, yellowish-brown (10YR 5/4) silty clay loam; common, fine and medium, faint, yellowish-brown (10YR 5/8) mottles and common, medium, distinct, light brownish-gray (10YR 6/2) mottles; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky; firm; few roots; thin, continuous, dark grayish-brown (10YR 4/2) clay films on vertical ped faces and thin, patchy, brown (10YR 5/3) clay films on horizontal ped faces; few, fine, prominent, black (10YR 2/1) stains and concretions; 3 percent pebbles; neutral; clear, wavy boundary.

IIB22tg—27 to 36 inches, grayish-brown (10YR 5/2) silty clay loam; common, fine and medium, distinct, yellowish-brown (10YR 5/6) and brown (7.5YR 4/4) mottles; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky; very firm; few roots; medium, continuous, dark-gray (10YR 4/1) clay films on vertical ped faces and thin, very patchy, dark grayish-brown (10YR 4/2) clay films on horizontal ped faces: common, fine and medium, prominent, black (10YR 2/1) stains and concretions; 5 percent pebbles; neutral; clear, wavy boundary.

IIB23tg—36 to 43 inches, gray (10YR 5/1) silty clay; common, medium, distinct, brown (7.5YR 4/4) and strong-brown (7.5YR 5/6) mottles; weak, coarse, subangular blocky structure; firm; few roots; thin, patchy, dark grayish-brown (2.5Y 4/2) clay films on vertical ped faces; common, medium, prominent, black (10YR 2/1) stains and concretions; 5 percent pebbles; mildly alkaline; abrupt, wavy boundary.

IIB3–43 to 54 inches, brown (10YR 4/3) gravelly clay; common, medium, distinct, yellowish-brown (10YR 5/6) and gray (10YR 5/1) mottles; weak, coarse, subangular blocky structure; friable; 20 percent pebbles; moderately alkaline; clear, wavy boundary.

IIC1—54 to 60 inches, brown (10YR 4/3) gravelly loam; weathered stone material of brownish yellow (10YR 6/8), light yellowish brown (10YR 6/4) and light brownish gray (10YR 6/2); massive; very friable; common, medium, prominent, black (10YR 2/1) stains and concretions; 40 percent pebbles; moderately alkaline, calcareous; clear, irregular boundary.

IIC2—60 to 63 inches, dark-gray (10YR 4/1) gravel and sand; single grained; loose; 70 percent pebbles; moderately alkaline, calcareous.

The solum is 40 to 60 inches thick. The silty mantle of loess or alluvium is 10 to 20 inches thick. The depth to calcareous gravel and sand ranges from 50 to 60 inches.

Reaction is medium acid or strongly acid in the A horizon, depending on whether lime has been applied. The Ap horizon has a hue of 10YR and 2.5Y, value of 4 and 5, and chroma of 2. Profiles in undisturbed areas have an A1 horizon that is very dark gray (10YR 3/1), very dark brown (10YR 2/2), or very dark grayish-brown (10YR 3/2) and is 2 to 6 inches thick. The A2 horizon is yellowish-brown (10YR 5/4), brown (10YR 4/3 and 5/3), or dark grayish-brown (10YR 4/2). It is 3 to 8 inches thick.

The Bt horizon has a hue of 10YR and 7.5YR, value of 3 to 6, and chroma of 1 through 6. It is fine silt loam, silty clay loam, silty clay, and clay, and in some profiles the lower part of the Bt horizon is gravelly. The Bt horizon is strongly acid to slightly acid in the upper part and medium acid to mildly alkaline in the lower part. Mottles occur immediately below the Ap or A1 horizon and throughout the B horizon. They have a hue of 10YR and 7.5YR, value of 4 through 6, and chroma of 1 through 8. Clay films in the Bt horizon are thin and medium, patchy and continuous, and have a hue of 2.5Y, 10YR and 7.5YR, value of 3 to 5, and chroma of 0 to 3.

The B3 horizon has a hue of 10YR and 7.5YR, value of 4 and 5, and chroma of 1 to 3. In some profiles the colors of the matrix and mottles are reversed. The B3 horizon is gravelly in many places. It is neutral to moderately alkaline.

The C horizon has a hue of 10YR and 7.5YR, value of 4 and 5, and chroma of 1 to 3.

Sleeth soils are part of the drainage sequence that includes well drained Ockley soils, moderately well drained Thackery soils, and very poorly drained, dark-colored Westland soils. They are less acid than Fitchville soils. Sleeth soils are underlain by calcareous sand and gravel, but McGary soils are underlain by clayey lacustrine sediment and Fincastle, Crosby, and Avonburg soils are underlain by calcareous glacial till. Sleeth soils lack the fragipan of Avonburg soils.

SlA—Sleeth silt loam, 0 to 2 percent slopes. This nearly level to slightly depressional soil is on stream terraces. It is commonly adjacent to more sloping or steep soils and, in places, is between Ockley or Thackery soils and Westland soils. Areas are narrow to broad and somewhat irregularly shaped. They cover 3 to 20 acres.

Included with this soil in mapping are a few areas of dark-colored Westland soils in narrow bands along drainageways and in small depressions at the head of drainageways.

This soil receives much runoff and deposits of silty soil material from more sloping soils. The silty surface layer has a tendency to puddle when wet, crust when dry, and heave when it freezes. These characteristics, seasonal wetness, and ponding are limitations for farming. Wetness is a limitation for many nonfarm uses. Capability unit IIw–2; woodland suitability group 2w2.

Sloan Series

The Sloan series consists of very poorly drained, nearly level soils. These soils formed in alluvium washed from soils that formed in calcareous glacial till of Wisconsin age. They are on flood plains. The native vegetation was water-tolerant hardwood forest in which elm, ash, sycamore, swamp and pin oaks, and soft maple were dominant.

In a representative profile in a cultivated area, the upper 9 inches of the surface layer is very dark grayish-brown silt loam. The next 6 inches is very dark gray silt loam. Below that is black silt loam 8 inches thick. The subsoil extends to a depth of 45 inches. The upper 15 inches is dark-gray silt loam that has grayish-brown, yellowish-brown, and dark yellowish-brown mottles. The lower 7 inches is dark-gray sandy loam that has brown and yellowish-brown mottles. The substratum, to a depth of 60 inches, is dark-gray and gray loamy sand that has dark yellowish-brown and dark-red mottles and, to a depth of 70 inches, is brown and dark-gray loose sand.

The available water capacity is high in Sloan soils. Permeability is moderate, and surface runoff is very slow to ponded. These soils are naturally wet and are subject to periodic flooding. The root zone is moderately deep to deep and is slightly acid to mildly alkaline. Sloan soils have a high content of organic matter.

Sloan soils are used mainly for corn, soybeans, wheat, and grass-legume mixtures for hay and pasture. A moderate acreage is subject to frequent flooding and is in permanent pasture, is wooded, or is idle.

Representative profile of Sloan silt loam, in a cultivated field 1¾ miles west of Highland on State Route 128, ¾ mile north on Careytown Road, ½ mile west of road, and 65 feet east of Lees Creek, in Fairfield Township:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam, dark brown (10YR 3/3) when rubbed; moderate, medium and fine, granular structure; friable; common roots; neutral; abrupt, smooth boundary.

A11—9 to 15 inches, very dary gray (10YR 3/1) silt loam, very dark grayish brown (10YR 3/2) when rubbed; weak, fine, subangular blocky structure; friable, common roots; neutral; gradual, wavy boundary.

A12—15 to 23 inches, black (10YR 2/1) silt loam, very dark gray (10YR 3/1) when rubbed; weak, coarse, subangular blocky structure parting to moderate, fine, subangular blocky; friable; common roots; neutral; clear, wavy boundary.

B2g—23 to 38 inches, dark-gray (10YR 4/1) silt loam; few, fine, faint, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/6) mottles and many, medium, distinct, dark yellowish-brown (10YR 3/4) mottles; weak, medium and coarse, subangular blocky structure; friable; few roots; neutral; gradual, wavy boundary.

B3g—38 to 45 inches, dark-gray (10YR 4/1) sandy loam; many, medium, distinct, brown (10YR 5/3) and yellowish-brown (10YR 5/4) mottles; massive; friable; 5 percent pebbles; mildly alkaline; gradual, wavy boundary.

C1g—45 to 60 inches, dark-gray (10YR 4/1) and gray (10YR 5/1) loamy sand; common, medium, distinct, dark yellowish-brown (10YR 4/4) mottles and common, medium, prominent, dark-red (2.5YR 3/6) mottles; massive; very friable to loose; 5 percent pebbles; mildly alkaline, calcareous; clear, wavy boundary.

C2—60 to 70 inches, brown (10YR 5/3) and dark-gray (N 4/0) sand; single grained; loose; 10 percent pebbles; mildly alkaline, calcareous.

The depth to calcareous material is typically 30 to 50 inches. Reaction in the solum ranges from slightly acid to moderately alkaline but is commonly neutral or mildly alkaline.

The A horizon is black (10YR 2/1), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2).

The B horizon is commonly dark gray (10YR 4/1 and 4/0), gray (10YR 5/1), and grayish brown (10YR 5/2). Mottles have a hue of 10YR and 7.5YR, value of 3 to 5, and chroma of 3 through 6. The B2 horizon is commonly silt loam and silty clay loam, but in some places it is loam and clay loam.

The C horizon is dark gray (10YR 4/1 and 4/0) or gray (10YR 5/1). It has mottles similar to those of the B horizon but that have a hue of 2.5YR in some places. The C horizon is highly stratified in the lower part with clay loam, silty clay loam, sandy loam, and loamy sand. Sand and, in places, gravel are at a depth of 5 to 8 feet.

Sloan soils are part of the drainage sequence that includes well drained Stonelick and Genesee soils, moderately well drained Eel soils, and somewhat poorly drained Shcals. Sloan soils have a darker colored A horizon than Stonelick, Genesee, and Eel soils. They lack the more highly developed, more clayey B horizon of Westland soils. They contain more sand in the solum than Patton soils. Sloan soils lack the dark-colored, buried soil of Algiers soils.

Sn—Sloan silt loam. This nearly level soil is on flood plains, commonly in depressions near the base of sloping soils. Areas cover 2 to 30 acres.

Included with this soil in mapping are Eel and Shoals soils and soils that have a surface layer of loam, silty clay loam, or clay loam. Where this soil extends up small waterways, Algiers soils are also included.

This soil is subject to flash flooding, particularly along small streams. Because it formed in alluvium that has a high content of lime, additional lime is generally not needed for crops. A seasonal high water table and flooding are limitations for nonfarm uses. Capability unit IIIw-3; woodland suitability group 2w1.

Stonelick Series

The Stonelick series consists of well-drained, nearly level soils that formed in recent and old alluvium eroded from glacial till. These soils are on the flood plains of the major streams and their tributaries. The native vegetation was hardwood forest in which beech, elm, sycamore, ash, oak, and maple were dominant.

In a representative profile, the surface layer is brown loam 8 inches thick. The substratum extends to a depth of 60 inches. The upper 6 inches is yellowish-brown loam. The next 11 inches is yellowish-brown and dark yellowish-brown sandy loam. The next 9 inches is yellowish-brown loamy sand. The lower 26 inches is yellowish-brown gravelly sand.

The available water capacity is low, and Stonelick soils tend to be droughty. Permeability is moderately rapid, and surface runoff is slow. These soils are subject to occasional flooding. The root zone is shallow and is commonly neutral to mildly alkaline.

Stonelick soils are used mainly for permanent pasture and woodland, although some corn, wheat, and oats are grown. A large acreage that is subject to periodic flooding is idle and is reverting to forest.

Representative profile of Stonelick loam, in a cultivated field 3 miles north of Hillsboro on U.S. Highway 62, ⅝ mile west on Evans Road, and 125 feet south of road and Clear Creek, in Liberty Township:

Ap—0 t 8 inches, brown (10YR 4/3) loam; weak, fine and medium, granular structure; very friable; common roots; neutral; abrupt, smooth boundary.

C1—8 to 14 inches, yellowish-brown (10YR 5/4) loam; weak, coarse and medium, granular structure; very friable; few roots; mildly alkaline, calcareous; clear, wavy boundary.

C2—14 to 25 inches, yellowish-brown (10YR 5/4) and dark yellowish-brown (10YR 4/4) sandy loam; massive; very friable; 5 percent pebbles; mildly alkaline, calcareous; clear, wavy boundary.

C3—25 to 34 inches, yellowish-brown (10YR 5/4) loamy sand; single grained; loose; 10 percent pebbles; mildly alkaline, calcareous; gradual, wavy boundary.

C4—34 to 60 inches, yellowish-brown (10YR 5/4) gravelly sand; single grained; loose; 25 percent gravel; mildly alkaline, calcareous.

Depth to loose sand ranges from 20 to 40 inches. Gravel content is 5 to 25 percent. Reaction in the profile ranges from neutral to moderately alkaline.

The Ap horizon is brown (10YR 5/3), dark brown (10YR 4/3), yellowish brown (10YR 5/4), or dark yellowish brown (10YR 4/4). Profiles in undisturbed areas have an A1 horizon that is very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2) and is 1 to 3 inches thick.

The C horizon is commonly yellowish brown (10YR 5/4 and 5/6), brown (10YR 4/3 and 5/3), or dark yellowish brown (10YR 4/4), but it has a hue of 7.5YR in places.

Stonelick soils are part of the drainage sequence that includes well drained Genesee soils, moderately well drained Eel soils, somewhat poorly drained Shoals soils, and very poorly drained, dark-colored Sloan soils. They lack the B horizon of Fox and Casco soils, and they contain less clay than Genesee and Ross soils. Stonelick soils lack the dark-colored A horizon of Ross soils, and they are shallower to calcareous sand and gravel than Ockley soill.

St—Stonelick loam. This nearly level soil is on flood plains, high water channels, and slight rises. Areas range from 2 to 50 acres. Slopes are mostly 0 to 2 percent, but some are as much as 4 percent.

Included with this soil in mapping are Genesee and Eel soils, dark-colored Ross soils, and soils that have a surface layer of sandy loam.

This soil is droughty and is subject to occasional flooding. Because it formed in alluvium that has a high content of lime, additional lime is generally not needed for crops. Droughtiness and flooding are the main limitations for farming and for nonfarm uses. Capability unit IIs–2; woodland suitability group 2o1.

Thackery Series

The Thackery series consists of moderately well drained, nearly level to gently sloping soils. These soils formed in loess or alluvium over material weathered from calcareous sand and gravel. They are on stream terraces in the Wisconsin and Illinoian glaciated areas. The native vegetation was hardwood forest in which beech, hickory, oak, and sugar maple were dominant.

In a representative profile in a cultivated area, the surface layer is dark grayish-brown silt loam 8 inches thick. The subsurface layer is brown silt loam 4 inches thick. The subsoil extends to a depth of 50 inches. The upper 6 inches is yellowish-brown silty clay loam. The next 12 inches is yellowish-brown clay loam that has grayish-brown and yellowish-brown mottles. The next 8 inches is grayish-brown gravelly clay loam that has yellowish-brown and brown mottles. The lower 12 inches is gray gravelly sandy clay loam that has yellowish-brown mottles. The substratum, to a depth of 62 inches, is brown and gray, loose sand and gravel.

The available water capacity is high in Thackery soils. Permeability is moderate in the solum and rapid in the substratum. Surface runoff is slow to medium, depending on slope. The root zone is deep and is commonly slightly acid to strongly acid.

Thackery soils are used mainly for corn, soybeans, wheat, and grass-legume mixtures for hay and pasture. A small acreage is in woodland and permanent pasture.

Representative profile of Thackery silt loam, 2 to 6 percent slopes, in a cultivated field 2½ miles north of Hillsboro on U.S. Highway 62, ⅝ mile east-southeast of U.S. Highway 62, and ⅛ mile north of Clear Creek, in Liberty Township:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine and medium, granular structure; very friable; common roots; slightly acid; abrupt, smooth boundary.

A2—8 to 12 inches, brown (10YR 5/3) silt loam, weak, medium, platy structure; friable; few roots; dark grayish-brown (10YR 4/2) coatings on ped faces; medium acid; clear, smooth boundary.

B1t—12 to 18 inches, yellowish-brown (10YR 5/4) silty clay loam; weak, fine and medium, subangular blocky structure; friable; few roots; thin, very patchy, dark-brown (10YR 4/3) clay films on ped faces; medium acid; clear, wavy boundary.

IIB21t—18 to 24 inches, yellowish-brown (10YR 5/4) clay loam; many, medium, distinct, grayish-brown (10YR 5/2) mottles and few, medium, faint, yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; firm; few roots; thin, continuous, dark-brown (10YR 4/3) clay films on ped faces; few, fine, prominent, black (10YR 2/1) stains and concretions; 10 percent pebbles; strongly acid; clear, wavy boundary.

IIB22t—24 to 30 inches, yellowish-brown (10YR 5/4) clay loam; many, medium, distinct, grayish-brown (10YR 5/2) mottles and few, fine, faint, yellowish-brown (10YR 5/8) mottles; moderate, fine and medium, subangular blocky structure; firm; thin, patchy, dark-brown (7.5YR 4/4) clay films on ped faces; few, fine, prominent, black (10YR 2/1) stains and concretions; 10 percent pebbles; medium acid; gradual, wavy boundary.

IIB23t—30 to 38 inches, grayish-brown (10YR 5/2) gravelly clay loam; many, fine and medium, distinct, yellowish-brown (10YR 5/6) mottles and few, fine, distinct, brown (10YR 4/3) mottles; weak, coarse, subangular blocky structure; firm; thin, very patchy, dark-brown (7.5YR 4/4) clay films on ped faces; few, fine, distinct, black (10YR 2/1) stains and concretions; 20 percent gravel; slightly acid; clear, wavy boundary.

IIB3—38 to 50 inches, gray (10YR 5/1) gravelly sandy clay loam; common, medium, distinct, yellowish-brown (10YR 5/4 and 5/6) mottles; weak, coarse, subangular blocky structure; friable; few, fine, prominent, black (10YR 2/1) stains and concretions; 25 percent gravel; neutral; clear, irregular boundary.

IIC—50 to 62 inches, brown (10YR 5/3) and gray (10YR 5/1) sand and gravel; single grained; loose; 45 percent gravel and cobbles; mildly alkaline, calcareous.

The thickness of the solum and the depth to calcareous loose sand and gravel range from 40 to 60 inches. The loess or silty alluvium is 10 to 30 inches thick. Reaction in the solum is medium acid or strongly acid in the A2 horizon through the upper part of the B2t horizon, is medium acid or slightly acid in the lower part of the B2t horizon, and is neutral or mildly alkaline in the B3 horizon.

The Ap horizon has a hue of 10YR, value of 4 or 5, and chroma of 2 or 3. Profiles in undisturbed areas have an A1 horizon that is very dark grayish brown (10YR 3/2), very dark gray (10YR 3/1), or dark gray (10YR 4/1) and is 2 to 4 inches thick. The A2 horizon, or in some profiles an A&B horizon or a B&A horizon, is yellowish brown (10YR 5/4), brown (10YR 4/3 and 5/3), or light yellowish brown (10YR 6/4).

The B1t horizon and the upper part of the B2t horizon have a hue of 10YR and 7.5YR, value of 4 and 5, and chroma of 3 or 4. The lower part of this B2t horizon has a chroma of 2 or less. The Bt horizon is silty clay loam, clay loam, or sandy clay loam. The lower part of the B2t horizon is gravelly in some places. Clay films are thin and medium and very patchy to continuous. They have a hue of 10YR and 7.5YR, value of 3 to 5, and chroma of 3 to 6. Mottles that have a chroma of 2 or less begin at a depth of 12 to 26 inches. They are grayish brown (10YR 5/2), dark gray (10YR 5/1), and light brownish gray (10YR 6/2).

The B3 horizon commonly has a hue of 10YR, value of 4 and 5, and chroma of 0 to 4. It is silty clay loam, clay loam, or sandy clay loam and is gravelly in places.

The C horizon is commonly brown (10YR 5/3 and 4/3) or yellowish brown (10YR 5/4). In places it has mottles of gray (10YR 5/1), dark gray (10YR 4/1), and dark grayish brown (10YR 5/2). The colors of the matrix and mottles are reversed in some profiles.

Thackery soils are part of the drainage sequence that includes well-drained Ockley soils, somewhat poorly drained Sleeth soils, and very poorly drained, dark-colored Westland soils. They differ from Ockley soils in having low-chroma mottles in the B horizon. Thackery soils are not so gray in the subsoil as Sleeth soils, and their solum is more acid than that of Eel soils.

ThA—Thackery silt loam, 0 to 2 percent slopes. This nearly level soil is on slightly convex stream terraces. It is between Ockley and Sleeth soils and is also adjacent to dark-colored Ross soils and other alluvial soils. Areas are narrow to broad, somewhat irregularly shaped, and generally elongated. They cover 5 to 20 acres.

Included with this soil in mapping are a few areas of Sleeth soils. A few areas of dark-colored Westland soils are included in narrow bands along drainageways and in slight depressions at the head of drainageways. Also included are a few small areas that have a surface layer of loam that contains a small amount of gravel.

This soil has few limitations for farming. It is well suited to nursery crops, truck crops, and sod production. A seasonal high water table and rapid permeability in the underlying gravel and sand are limitations for some nonfarm uses. Capability unit I–1; woodland suitability group 1o1.

ThB—Thackery silt loam, 2 to 6 percent slopes. This gently sloping soil is mostly in long, narrow bands along streams. It is also in narrow to broad, long, somewhat irregularly shaped areas on slightly convex stream terraces. Areas cover 5 to 20 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few areas of Sleeth soils. A few areas of dark-colored Westland soils are included in narrow bands along drainageways and in slight depressions at the head of drainageways. Also included are areas of moderately eroded Thackery soils. Some of these areas have a surface layer of loam to sandy loam that contains a small amount of gravel. Some areas of Ockley soils are also included.

The hazard of erosion is moderate, and some measures for controlling erosion are necessary if this soil is cultivated. The soil is suited to nursery crops, truck crops, and sod production. Slope and the rapid permeability in the underlying gravel and sand are limitations for some nonfarm uses. Capability unit IIe-1; woodland suitability group 1o1.

Trappist Series

The Trappist series consists of well-drained, gently sloping to steep soils that formed in loess and the underlying residual or colluvial material. They are on uplands, footslopes, and benches in the unglaciated part of the county. The native vegetation was a forest of oak, hickory, yellow-poplar, and pine.

In a representative profile, the surface layer is dark-gray silt loam 1 inch thick. The subsurface layer is brown silt loam 5 inches thick. The subsoil extends to a depth of 27 inches. The upper 3 inches is yellowish-brown silty clay loam that has brown mottles. The next 5 inches is brown silty clay loam. The next 7 inches is brown shaly silty clay. The lower 6 inches is brown very shaly silty clay loam. The substratum, to a depth of 32 inches, is dark-brown and yellowish-red very shaly silty clay loam. Shale bedrock is at a depth of 32 inches.

The available water capacity is medium to low in Trappist soils. Permeability is slow, and surface runoff is medium. The root zone is moderately deep and is commonly strongly acid to extremely acid.

Trappist soils are mostly in forest. Corn, wheat, and tobacco are grown on some less eroded, less sloping areas. Some areas are in permanent pasture, and some are idle and are reverting to forest.

Representative profile of Trappist silt loam, 18 to 25 percent slopes, in an uncultivated area 3½ miles north of Sinking Spring on State Route 41, and 275 feet east of State Route 41 and roadside park, in Brush Creek Township:

A1—0 to 1 inch, dark-gray (10YR 4/1) silt loam; weak, fine, granular structure; very friable; many roots; 4 percent shale fragments; very strongly acid; abrupt, smooth boundary.

A2—1 to 6 inches, brown (10YR 5/3) silt loam; weak, medium, subangular blocky structure parting to moderate, fine, granular; friable; many roots; 4 percent shale fragments; very strongly acid; clear, smooth boundary.

B1—6 to 9 inches, yellowish-brown (10YR 5/4) silty clay loam; common, fine, faint, brown (10YR 5/3) mottles; weak, fine and medium, subangular blocky structure; friable; common roots; 4 percent shale fragments; very strongly acid; clear, smooth boundary.

B21t—9 to 14 inches, brown (7.5YR 5/4) silty clay loam; moderate, fine, subangular blocky structure; friable; common roots; thin, very patchy, reddish-brown (5YR 5/4) clay films on ped faces; 4 percent shale fragments; very strongly acid; clear, wavy boundary.

IIB22t—14 to 21 inches, brown (7.5YR 4/4) shaly silty clay; moderate, fine, subangular blocky structure; firm; common roots; thin, patchy, reddish-brown (5YR 5/4) clay films on vertical and horizontal ped faces; 40 percent shale fragments; very strongly acid; gradual, wavy boundary.

IIB3—21 to 27 inches, brown (7.5YR 4/4) very shaly silty clay loam; weak, fine and medium, subangular blocky structure; firm; common roots; 55 percent shale fragments; very strongly acid; gradual, wavy boundary.

IIC—27 to 32 inches, dark-brown (7.5YR 4/4) and yellowish-red (5YR 4/6) very shaly silty clay loam; moderate, thin and medium, relict, platy structure and small pockets of weak, coarse, subangular blocky structure; firm; many light yellowish-brown (10YR 6/4), light brownish-gray (10YR 6/2), and pink (7.5YR 7/4) coatings on shale fragments; extremely acid; clear; wavy boundary.

IIR—32 inches, acid, black, fissile shale bedrock.

The solum is 20 to 40 inches thick, and the loess mantle is 4 to 18 inches thick. The depth to shale bedrock ranges from 20 to 40 inches but is commonly 24 to 34 inches. Reaction ranges from strongly acid to extremely acid except where the soil has been limed.

Profiles undisturbed by plowing have an A1 horizon that is very dark grayish brown (10YR 3/2), dark grayish brown (10YR 4/2), or dark gray (10YR 4/1) and is 1 to 3 inches thick. Profiles in plowed areas have an Ap horizon that is dark brown (10YR 4/3), brown (10YR 5/3), or yellowish brown (10YR 5/4). The A2 horizon is brown (10YR 5/3 and 4/3) or yellowish brown (10YR 5/4).

The B2t horizon has a hue of 7.5YR and 10YR, value of 4 and 5, and chroma of 4 and 6. It is silty clay loam, silty clay, or clay and is shaly in places.

In the C horizon, the matrix and shale fragment coatings have a hue of 10YR to 5YR, value of 4 to 7, and chroma of 1 to 6. In many places the colors are variegated.

Trappist soils are next to Colyer and Muse soils. They are shallower to shale bedrock than Muse soils. Unlike Wellston soils, Trappist soils are underlain by shale bedrock. They are deeper to shale bedrock than Colyer soils, and they lack the glacial till of Cana soils.

TrE—Trappist silt loam, 18 to 25 percent slopes. This steep soil is on ridgetops and toe slopes in the unglaciated uplands. It is mostly in long areas, but some areas are narrow to broad and oval or rounded to irregularly shaped. Many areas extend perpendicular to drainageways for several hundred feet. Some areas cover as much as 85 acres, but most are 3 to 25 acres. In most places slopes are convex and are 150 to 450 feet long. This soil has the profile described as representative of the series.

Included with this soil in mapping are some areas of moderately eroded or severely eroded Trappist soils that have a shaly or finer textured surface layer. These areas are dissected by shallow to deep gullies, support little or no vegetation, and have scattered bedrock outcrops. Also included are many areas of Colyer soils that have a shaly surface layer, a few areas of Cana soils, a few areas of Wellston soils, and a few areas of a redder, well-drained soil. Some seep areas, springs, and soil slumps are included in the middle or at the base of many slopes.

Slopes, susceptibility to erosion and to soil slumping, and depth to bedrock are severe limitations for farming and for nonfarm uses. The soil is suited to trees and other permanent vegetation. Capability unit IVe-5; woodland suitability group 2r1.

TsB—Trappist-Muse silt loams, 2 to 6 percent slopes. These gently sloping soils are on ridgetops, toe slopes, and benches in the unglaciated uplands. They are mostly in long areas, but some areas are narrow to broad and oval or rounded to irregularly shaped. Areas range from 3 to 25 acres, but most are 3 to 12 acres. In most places slopes are convex and are 150 to 450 feet long. This mapping unit is about 50 percent Trappist soils and 35 percent Muse and other soils.

These soils have profiles similar to the ones described as representative of the Trappist and Muse series. They are next to or associated with Colyer, Nicholson, Bratton, Opequon, and Cana soils.

Included with these soils in mapping are a few areas of a moderately well drained soil in slight depressions and along drainageways. This soil formed in acid, clayey residuum weathered from shale. Also included are many areas of Wellston soils and a few areas of a redder, well-drained soil in more sloping, eroded places.

These soils have moderately low natural fertility, and they require a large amount of lime for cultivated crops. The hazard of erosion is moderate, and some measures are needed for controlling erosion if cultivated crops are grown. Slow permeability, depth to bedrock, and a moderate shrink-swell potential are limitations for many nonfarm uses. Capability unit IIe–4; woodland suitability group 2o1.

TsC2—Trappist-Muse silt loams, 6 to 12 percent slopes, moderately eroded. This mapping unit is about 60 percent Trappist soils and 40 percent Muse and other soils. These soils form such an intricate pattern that it is not practical to show them separately at the scale of mapping used. These sloping soils are on ridgetops, toe slopes, and benches of the unglaciated upland. The soil areas are narrow to broad, and oval or rounded to irregularly shaped, but most are long and have convex slopes 150 to 450 feet long. Areas range from 3 to 25 acres in size but generally are 3 to 12 acres. The Trappist soil has a profile similar to the one described as representative of the Trappist series, except for color, texture, and thickness of the surface layer. The Muse soil has the profile described as representative of the Muse series.

Included with these soils in mapping are many areas of slightly eroded Trappist-Muse soils in woodland and pasture; a few areas, along drainageways, of a moderately well drained soil that formed in residuum weathered from acid clayey shale; and many steeper, severely eroded areas, of Colyer soils, Wellston soils, and a redder, well-drained soil that is dissected by shallow gullies and has a surface layer of shaly silty clay loam. The severely eroded areas are identified on the soil map by spot symbols.

These soils have low natural fertility, and they require large amounts of lime if certain crops are grown. Erosion and slope are limitations to farm uses of this soil. Slope, slow permeability, depth to bedrock, a moderate shrink-swell potential, and soil slumping are limitations to nonfarm uses. Capability unit IIIe–5; woodland suitability group 2o1.

TsD2—Trappist-Muse silt loams, 12 to 18 percent slopes, moderately eroded. This mapping unit is about 65 percent Trappist soils and 35 percent Muse and other soils. These soils form such an intricate pattern that it is not practical to show them separately at the scale of mapping used. The moderately steep soils occupy the side slopes of narrow ridgetops, and toe slopes on unglaciated upland. The soil areas are narrow to broad, and oval or rounded to irregularly shaped, but most areas are long and have convex slopes 150 to 450 feet long. They range from 3 to 36 acres in size but generally are 3 to 15 acres. The Trappist soil has a profile similar to the one described as representative of the Trappist series, except for color, texture, and thickness of the surface layer.

Included with these soils in mapping are many areas of slightly eroded Trappist and Muse soils in pasture and woodland and a few areas of a moderately well drained soil that weathered in residuum from acid clayey shale along drainageways. Also included are few to many areas

of Colyer, Wellston, and Cana soils and a redder, well-drained soil and some seepy areas and springs at the base of many slopes. Other inclusions are many areas of severely eroded Trappist and Muse soils that are dissected by shallow gullies. Areas that, in many places, have a shaly, finer textured surface layer, little or no vegetative cover, and a few outcrops of bedrock are identified on the soil map by a spot symbol.

A considerable part of the acreage is in permanent pasture or woodland. The soils are suited to permanent vegetation, but they have severe limitations for cultivated crops. Slope, slow permeability, depth to bedrock, and soil slumping are severe limitations to nonfarm uses. Capability unit IVe–5; woodland suitability group 2r1.

Tuscarawas Series

The Tuscarawas series consists of moderately well drained and well drained, sloping to very steep soils that formed in channery colluvium and in residuum weathered from clayey acid shale. These soils are in areas downslope where colluvium has accumulated, on toe slopes, and on benches of dissected unglaciated uplands. The native vegetation was a hardwood forest of oak, hickory, yellow-poplar, maple, and beech.

In a representative profile, in a forested area, a layer of hardwood leaf litter, 1 inch thick, is on the surface. Beneath this the surface layer is very dark grayish-brown and dark grayish-brown channery silt loam 9 inches thick. The subsoil extends to a depth of 45 inches. The upper 6 inches is yellowish-brown channery silt loam. The next 8 inches is yellowish-brown channery clay loam. The next 13 inches is yellowish-brown channery clay loam mottled with light brownish gray. The lower 9 inches is light yellowish-brown silty clay mottled with gray and yellowish brown. The substratum, to a depth of 60 inches, is light yellowish-brown silty clay mottled with gray and yellowish brown.

The available water capacity is medium to low. Permeability is moderate in the upper part of the solum and slow in the lower part. Surface runoff is medium to rapid, depending on the slope. The root zone is moderately deep to deep, and is medium acid to extremely acid.

Tuscarawas soils are mainly in forest. In the past, some of the areas were cleared for pasture and crops. Now much of this land is idle and reverting to forest.

Representative profile of Tuscarawas channery silt loam, 18 to 35 percent slopes, in a forested area, 2¼ miles south-southwest of Carmel, 0.4 mile south of Millerstown Road, 300 yards south-southeast of farmstead on Washburn Hill, in Brush Creek Township:

O1—1 inch to 0, deciduous hardwood leaf litter and partly decomposed leaf litter.

A11—0 to 1 inch, very dark grayish-brown (10YR 3/2) channery silt loam; moderate, fine, granular structure; very friable; many roots; 20 percent coarse fragments; slightly acid; abrupt, smooth boundary.

A12—1 to 9 inches, dark grayish-brown (10YR 4/2) channery silt loam; moderate, medium, granular structure; very friable; many roots; 25 percent coarse fragments; medium acid; clear, smooth boundary.

B1t—9 to 15 inches, yellowish-brown (10YR 5/4) channery heavy silt loam; weak, fine and medium, subangular blocky structure; friable; common roots; thin, very patchy dark-brown (10YR 4/3) and brown (10YR 5/3) clay films on ped faces and on coarse fragments; dark grayish-brown (10YR 4/2) organic coatings in old root channels; 25 percent coarse fragments; strongly acid; clear, wavy boundary.

B21t—15 to 23 inches, yellowish-brown (10YR 5/6) channery clay loam; moderate, fine and medium, subangular blocky structure; friable; common roots; thin, patchy brown (7.5YR 4/4) clay films on ped faces and on coarse fragments; dark grayish-brown (10YR 4/2) organic coatings in old root channels; 25 percent coarse fragments; very strongly acid; clear, wavy boundary.

B22t—23 to 36 inches, yellowish-brown (10YR 5/4) channery clay loam; common, medium, distinct, light brownish-gray (10YR 6/2) mottles; weak, medium and coarse, subangular blocky structure; friable; few roots; thin, very patchy, brown (7.5YR 4/4) and (10YR 5/3) clay films on ped faces and coarse fragments; 50 percent coarse fragments; very strongly acid; abrupt, wavy boundary.

IIB3—36 to 45 inches, light yellowish-brown (2.5Y 6/4) silty clay; common, medium, distinct mottles of gray (10YR 6/1) and yellowish brown (10YR 5/6); weak, coarse, subangular and moderate, fine, angular blocky structure; firm; few roots; 5 percent coarse fragments; extremely acid; gradual, wavy boundary.

IIC—45 to 60 inches, light yellowish-brown (2.5Y 6/4) silty clay; many, medium, distinct mottles of gray (10YR 6/1) and few, medium, distinct mottles of yellowish brown (10YR 5/6); massive; very firm; few roots; 5 percent coarse fragments; extremely acid.

The solum is 20 to 50 inches thick, and the depth to shale bedrock is 3.5 to 6 feet. The upper part of the solum is 10 to 50 percent sandstone fragments, and the lower part is as much as 10 percent shale fragments. The upper part of the solum is slightly acid to very strongly acid and the lower part of the solum and the C horizon range from very strongly acid to extremely acid.

The A horizon is dark grayish brown (10YR 4/4), grayish brown (10YR 5/2), and dark brown (10YR 4/3). In undisturbed profiles, the A1 horizon is very dark grayish brown (10YR 3/2), dark brown (10YR 3/3), or very dark brown (10YR 2/2) and 1 to 3 inches thick.

The Bt horizon is most commonly yellowish brown (10YR 5/4 and 5/6) or brown (10YR 4/3 and 5/3) and 10 to 30 inches thick. It is silt loam, loam, or clay loam, that are channery in places. Clay films are thin, patchy and very patchy, and are dark brown (10YR 4/3), brown (10YR 4/3 and 5/3) and (7.5YR 4/4), and yellowish brown (10YR 5/4).

The B3 and C horizons are light yellowish brown (2.5Y 6/4) and light olive brown (2.5Y 5/4 and 5/6), and have common to many mottles of gray (10YR 6/1), yellowish brown (10YR 5/4 and 5/6), and brown (7.5YR 5/4 and 4/4).

Tuscarawas soils are adjacent to Berks, Muskingum, Neotoma, Colyer, and Trappist soils. Unlike Berks, Muskingum, and Neotoma soils, they are underlain by shale bedrock, and they lack a dark-colored A horizon, which Neotoma soils have. They are deeper to shale bedrock than Colyer and Trappist soils.

TuD—Tuscarawas channery silt loam, 6 to 18 percent slopes. This sloping to moderately steep soil is on colluvial toe slopes, and benches in unglaciated upland. Areas are generally small and rounded to somewhat rounded, but some areas are as much as 200 to 300 feet long. They have convex slopes 60 to 400 feet long, and generally cover 2 to 15 acres, but some are as many as 27 acres. This soil is adjacent to or closely associated with Colyer, Trappist, and Muse soils. In places the surface layer is as much as 25 percent sandstone and shale fragments, but the percentage varies considerably from place to place.

Included with this soil in mapping are many areas of moderately eroded Tuscarawas soils and a few small areas of severely eroded Tuscarawas soils. Also included are some areas of soils having a thin deposit of glaciated material. Some seeps and springs are in areas of this soil.

A considerable part of this soil is in pasture or forest. The soil is more suited to permanent vegetation than to cultivated crops. Slope, susceptibility to erosion, soil slumping, depth to bedrock, and stoniness are limitations to the use of this soil for farming and for nonfarm purposes. Capability unit IVe–5; woodland suitability group 2w3.

TuF—Tuscarawas channery silt loam, 18 to 35 percent slopes. This steep to very steep soil is on hillsides in the unglaciated upland. Areas are 150 to 650 feet wide and ¼ to ¾ mile long. They are generally 4 to 22 acres, but some are as much as 63 acres. Slopes are basically convex, and on them are many depressions and benches. This soil has the profile described as representative of the series. It is adjacent to and downslope from the steeper Berks, Muskingum, and Neotoma soils and is adjacent to or closely associated with Colyer, Trappist, and Muse soils. In places the surface layer is as much as 35 percent fragments of sandstone and shale, but the number of fragments varies considerably from place to place.

Included with this soil in mapping are some areas of moderately eroded and severely eroded Tuscarawas soils that have a finer textured surface layer dissected by gullies. These soils also contain many fragments of sandstone and shale. Also included are steeper Tuscarawas soils that are shallower to bedrock and have a finer textured surface layer.

This soil is suited to permanent vegetation, particularly trees, and most of the areas are in forest. Slope, susceptibility to erosion, soil slumping, depth to bedrock, and stoniness are severe limitations to nonfarm use. Capability unit VIe–3; woodland suitability group 2w3.

Warsaw Series

The Warsaw series consist of well-drained, nearly level to gently sloping soils that formed in outwash underlain by calcareous sand and gravel at a depth of 24 to 40 inches. These soils are on stream terraces. The native vegetation was prairie grasses, hickory, oak, and other hardwood trees.

In a representative profile, in a cultivated field, the upper part of the surface layer is very dark grayish-brown silt loam 11 inches thick. The lower part, to a depth of 16 inches, is very dark grayish-brown loam. The subsoil, to a depth of 28 inches, is dark yellowish-brown gravelly clay loam. The substratum, to a depth of 60 inches, is dark yellowish-brown, loose sand and gravel.

The available water capacity is medium to low in Warsaw soils. Permeability is moderate in the subsoil and rapid in the substratum. These soils are droughty in dry seasons. The content of organic matter in the surface layer is high. The root zone is moderately deep and is commonly slightly acid to strongly acid.

Warsaw soils are used mainly for corn, wheat, soybeans, and grass-legume mixtures for hay and pasture. A small acreage is in permanent pasture or woodland.

Representative profile of Warsaw silt loam, 0 to 2 percent slopes, in a cultivated field, 1 mile south-southwest of Monroe, 550 yards west of Monroe Road, and one-fourth mile north-northeast of Lee's Creek, in Fairfield Township:

Ap—0 to 5 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine and medium, granular structure; friable; many roots; slightly acid; abrupt, smooth boundary.

A12—5 to 11 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium and coarse, granular structure; friable; common roots; slightly acid; gradual, wavy boundary.

A13—11 to 16 inches, very dark grayish-brown (10YR 3/2) loam; common, medium, distinct, dark yellowish-brown (10YR 4/4) mottles; moderate, fine and medium, subangular blocky structure; friable; common roots; 4 percent pebbles; slightly acid; clear, wavy boundary.

B21t—16 to 21 inches, dark yellowish-brown (10YR 4/4) gravelly clay loam; weak, medium, subangular blocky structure parting to moderate, fine and medium, subangular blocky; firm; few roots; thin, patchy, dark-brown (10YR 3/3) clay films on vertical and horizontal ped faces; common, medium, distinct, very dark gray (10YR 3/1) stains and concretions; 25 percent pebbles; medium acid; gradual, wavy boundary.

B22t—21 to 28 inches, dark yellowish-brown (10YR 4/4) gravelly clay loam; weak, coarse, subangular blocky structure parting to moderate, medium, subangular blocky; firm; few roots; thin, patchy dark-gray (10YR 4/1) clay films on vertical and horizontal ped faces; common, medium, prominent, very dark grayish-brown (10YR 3/2) stains and concretions; 25 percent pebbles; neutral; clear, irregular boundary.

IIC—28 to 60 inches, dark yellowish-brown (10YR 4/4) sand and gravel; single grained; loose; few roots; 75 percent pebbles and cobbles; mildly alkaline, calcareous.

The thickness of the solum and depth to calcareous sand and gravel is commonly 24 to 40 inches. Some profiles have a mantle of loess that is as much as 12 inches thick in places. The A horizon is slightly acid to strongly acid, and the B2t horizon is medium acid to strongly acid in the upper part and slightly acid or neutral in the upper part.

The A horizon is very dark grayish brown (10YR 3/2), black (10YR 2/1), and very dark brown (10YR 2/2), and 12 to 18 inches thick.

The B2t horizon has hues of 10YR and 7.5YR, value of 3 and 4, and chroma of 4. It has thin patchy clay films of dark brown (10YR 3/3 and 4/3), very dark grayish-brown (10YR 3/2), or dark gray (10YR 4/1) and (N 4/0) and is 12 to 32 inches thick. It is loam, clay loam, and sandy clay loam that in places are gravelly. They are 10 to 35 percent gravel. In some profiles tongues of this horizon extend 3 to 10 inches or more into the C horizon.

The C horizon has hues of 10YR and 7.5YR, value of 3 and 4, and chroma of 4, and some profiles have dark grayish-brown (10YR 4/2), light brownish-gray (10YR 6/2), or gray (10YR 5/1 and 6/1) mottles. In some profiles the matrix and mottle colors are reversed.

Warsaw soils are associated with Wea and Fox soils in many places. They are darker colored than Fox soils and are less deep to calcareous sand and gravel than Wea soils. Warsaw soils are shallower to sand and gravel and have a thinner dark-colored A horizon than Ross soils. They have better natural drainage and are shallower to sand and gravel than Westland soils.

WaA—Warsaw silt loam, 0 to 2 percent slopes. This nearly level soil is on stream terraces. The soil areas are slightly convex, moderately broad, and irregularly shaped, but most areas are elongated. They cover 10 to 40 acres. Slopes are mostly 0 to 2 percent but range from 0 to 4 percent. This soil lies adjacent to and between the more sloping Fox, Casco, and Ockley soils on uplands and Ross and Genesee soils on flood plains.

Included with this soil in mapping are some areas of moderately eroded Warsaw soils that have a thinner, dark-colored surface layer that contains more gravel than the surface layer of most Warsaw soils; a few areas of Warsaw soils that have a surface layer of loam or gravelly loam; and some areas of Warsaw soils where 4 to 12 inches of lighter colored soil material from adjacent more sloping areas has been deposited. Also included are some areas of Wea soils.

This soil receives runoff and seepage from adjacent more sloping areas. The hazard of droughtiness is moderate.

This soil is suited to nursery crops, truck crops, and sod crops.

Aside from droughtiness, this soil has few, if any, limitations to farm use. Rapid permeability in the underlying gravel and sand is a limitation to some nonfarm uses. Capability unit IIs–1; woodland suitability group 2o1.

Wea Series

The Wea series consists of well-drained, nearly level to gently sloping soils that formed in outwash underlain by calcareous, stratified sand and gravel. These soils are on stream terraces. The native vegetation was prairie grasses intermixed with hickory, oak, and other hardwood trees.

In a representative profile, in a cultivated area, the surface layer is very dark grayish-brown silt loam to a depth of 12 inches and is very dark grayish-brown loam to a depth of 16 inches. The subsoil extends to a depth of 48 inches. The upper 11 inches is brown clay loam; the next 11 inches is brown gravelly clay loam; and the lower 10 inches is dark-brown gravelly clay loam. The substratum, to a depth of 60 inches, is dark yellowish-brown and yellowish-brown, loose sand and gravel.

The available water capacity is medium. Permeability is moderate in the subsoil and rapid in the substratum. The content of organic matter is high. The root zone is deep and is commonly slightly acid to strongly acid.

Wea soils are used mainly for corn, wheat, soybeans, and grass-legume mixtures for hay and pasture. A small acreage is in permanent pasture or woodland.

Representative profile of Wea silt loam, 2 to 6 percent slopes, in a cultivated field 1 mile south of Monroe, 250 feet east of Monroe Road, one-fourth mile north of Lees Creek, and 50 yards south of woods, in Fairfield Township:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine and medium, granular structure; very friable; many roots; slightly acid; abrupt, smooth boundary.

A12—8 to 12 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium and coarse, granular structure; friable; common roots; slightly acid; gradual, wavy boundary.

A13—12 to 16 inches, very dark grayish-brown (10YR 3/2) loam; common, fine and medium, distinct, dark yellowish-brown (10YR 4/4) mottles; moderate, fine and medium, subangular blocky structure; friable; common roots; 4 percent pebbles; medium acid; clear, wavy boundary.

B21t—16 to 27 inches, brown (7.5YR 4/4) clay loam; moderate, medium and coarse, subangular blocky structure; firm to friable; few roots; thin, very patchy, dark-brown (10YR 4/3 and 3/3) clay films on ped faces; 15 percent pebbles; strongly acid; gradual, wavy boundary.

B22t—27 to 38 inches, brown (7.5YR 4/4) gravelly clay loam; moderate, medium and coarse, subangular blocky structure; firm; thin and medium, patchy, dark-brown (10YR 4/3 and 3/3) clay films on ped faces; common, medium, distinct, very dark brown (10YR 2/2) stains and concretions; 25 percent pebbles; medium acid; gradual, wavy boundary.

B23t—38 to 48 inches, dark-brown (7.5YR 4/4) gravelly clay loam; weak, coarse, subangular blocky structure; firm; thin and medium, patchy dark-gray (10YR 4/1) and dark-brown (10YR 3/3) clay films on vertical ped faces; common, medium and coarse, distinct, very dark brown (10YR 2/2) stains and concretions; 35 percent pebbles; neutral; abrupt, irregular boundary.

IIC—48 to 60 inches, dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/4) sand and gravel; single grained; loose; 50 percent pebbles and cobbles; mildly alkaline, calcareous.

The thickness of the solum and the depth to calcareous sand and gravel are 40 to 70 inches. Some profiles have a mantle of loess or silty alluvium that is as much as 12 inches thick in places. The A horizon is slightly acid to medium acid; the upper part of the B2t horizon is strongly acid, but the lower part is slightly acid or neutral.

The A horizon is very dark grayish brown (10YR 3/2), very dark brown (10YR 2/2), and black (10YR 2/1) and 10 to 18 inches thick. It has moderate granular to weak or moderate subangular blocky structure.

The B2t horizon is typically dark yellowish-brown (10YR 4/4 or 3/4) or brown and dark-brown (7.5YR 4/4) loam, clay loam, and sandy clay loam. In places the lower part of the B horizon is gravelly. The B2t horizon is 10 to 35 percent gravel. It has thin and medium, patchy and very patchy clay films of brown (10YR 4/3), dark brown (10YR 3/3), dark grayish brown (10YR 3/2), or dark gray (10YR 4/1 and N 4/0), and is commonly 26 to 36 inches thick, but ranges from 20 to 48 inches in thickness. In some profiles tongues on the B2t horizon extend 3 to 10 inches into the C horizon.

The C horizon is dark yellowish brown (10YR 3/4 and 4/4), and brown or dark brown (7.5YR 4/4). Some profiles have light brownish-gray (10YR 6/2) or gray (10YR 5/1 and 6/1) mottles. In some profiles matrix and mottle colors are reversed.

Wea soils are associated with Warsaw and Fox soils. They are deeper to calcareous sand and gravel than Warsaw and Fox soils. Wea soils have a thinner, dark-colored A horizon than Ross soils. They lack the underlying material of calcareous loam glacial till, which Dana soils have.

WeA—Wea silt loam, 0 to 2 percent slopes. This nearly level soil is on stream terraces. The soil areas are slightly convex, moderately broad and irregularly shaped but are mainly elongated. They cover 10 to 40 acres. This soil is generally adjacent to and between the more sloping areas of Fox, Ockley, and Casco soils on uplands and the Ross and Genesee soils on flood plains.

Included with this soil in mapping are some areas of Wea soils that have a 4- to 12-inch deposition of lighter colored soil material from adjacent, more sloping areas. Also included are a few areas of Wea soils that have a surface layer of loam. Other inclusions are a few areas of Warsaw soils and a moderately well drained soil, underlain by sand and gravel, that is in slight depressions and along small drainageways.

This soil receives runoff and seepage from adjacent more sloping areas. It has few, if any, limitations to use for farming. It is well suited to nursery crops, truck crops, and sod production. Rapid permeability in the underlying gravel and sand is a limitation to some nonfarm uses. Capability unit I-1; woodland suitability group 1o1.

WeB—Wea silt loam, 2 to 6 percent slopes. This gently sloping soil is on stream terraces. The soil areas are slightly convex, in places broad and irregularly shaped but generally long and narrow. They cover 10 to 40 acres and generally are adjacent to and between the more sloping Casco, Fox, and Ockley soils on uplands and the Ross and Genesee soils on the flood plains. This soil has the profile described as representative of the series. The hazard of erosion is moderate.

Included with this soil in mapping are a few small areas of moderately eroded Wea soils that differ from this Wea soil in having a thinner surface layer of browner,

more gravelly loam. Also included are a few areas of Warsaw soils.

This soil is suited to nursery crops, truck farming, and sod production. Some measures are needed to control erosion if this soil is used for cultivated crops. Slope and rapid permeability of the underlying gravel and sand are limitations for some nonfarm uses. Capability unit IIe-1; woodland suitability group 1o1.

Wellston Series

The Wellston series consists of well-drained, sloping and moderately steep soils that formed in loess and the residuum of sandstone and siltstone. These soils are on ridgetops, toe slopes, and benches of the unglaciated uplands. The native vegetation was forest in which upland oak, sugar maple, yellow-poplar, and beech were dominant.

In a representative profile, in a cultivated area, the surface layer is dark grayish-brown silt loam 8 inches thick. The subsoil extends to a depth of 38 inches. The upper 6 inches is yellowish-brown silt loam; the next 10 inches is strong-brown silty clay loam; and the lower 14 inches is strong-brown channery silty clay loam mottled with red. The substratum, to a depth of 44 inches, is yellowish-brown channery clay loam. At a depth of 44 inches is sandstone bedrock.

The available water capacity is medium in Wellston soils. Permeability is moderate, and surface runoff is medium to rapid, depending on the slope. The root zone is moderately deep and is commonly strongly acid.

A considerable acreage of the sloping Wellston soils on ridgetops, benches, and toe slopes is used for wheat, oats, corn, grass-legume mixtures for hay and pasture, and tobacco. Moderately steep Wellston soils are used mainly for woodland or pasture. Presently much of the land that has been cleared is reverting to forest.

Representative profile of Wellston silt loam, 6 to 12 percent slopes, in a cultivated field, 2¼ miles south-southwest of Carmel, 774 yards south-southwest of Millerstown Road, and ¼ mile east of Milburn Road on Washburn Hill, in Brush Creek Township:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium and coarse, granular structure; friable; many roots; medium acid; abrupt, smooth boundary.

B1—8 to 14 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine and medium, subangular blocky structure; friable, common roots; medium acid; clear, wavy boundary.

B21t—14 to 24 inches, strong-brown (7.5YR 5/6) silty clay loam; moderate, medium and fine, subangular blocky structure; firm to friable; few roots; thin, patchy, dark-brown (7.5YR 4/4) and brown (7.5YR 5/4) clay films on ped faces; few, fine, prominent, black (10YR 2/1) stains and concretions; 5 percent sandstone fragments; strongly acid; clear, wavy boundary.

IIB22t—24 to 38 inches, strong-brown (7.5YR 5/6) channery silty clay loam; common, fine and medium, prominent, red (2.5YR 4/6) mottles; moderate, fine and medium, subangular blocky structure; firm; thin, patchy, dark-brown (7.5YR 4/4) clay films on ped faces; few, fine, prominent, black (10YR 2/1) stains and concretions; 15 percent sandstone fragments; very strongly acid; clear, wavy boundary.

IIC—38 to 44 inches, yellowish-brown (10YR 5/4 and 5/6) channery clay loam; weak, fine, subangular blocky structure in between the numerous fragments of sandstone; friable; some dark brown (7.5YR 4/4) clay films on fragments and in isolated pockets; 40 percent sandstone fragments; very strongly acid; abrupt, wavy boundary.

IIR—44 inches, fine-grained sandstone bedrock.

The solum is 32 to 50 inches thick and depth to bedrock is 40 to 72 inches. The mantle of loess is 12 to 30 inches thick. Content of coarse fragments ranges from 2 to 5 percent in the A and B1 horizons, 5 to 20 percent in the B2t horizon, and 35 to 60 percent in the C horizon. The A and B1 horizons are medium acid to strongly acid but the lower part of the solum and the C horizon are very strongly acid to extremely acid.

The Ap horizon is dark grayish brown (10YR 4/2), brown (10YR 4/3 and 5/3), and yellowish brown (10YR 5/4), but in undisturbed areas, the A1 horizon is very dark grayish brown (10YR 3/2) or very dark brown (10YR 2/2) and 1 to 3 inches thick.

The B1, B2t, and C horizons are commonly yellowish brown (10YR 5/4), brown (7.5YR 5/4), and strong brown (7.5YR 5/6). The B2t horizon, 18 to 26 inches thick, is heavy silt loam, silty clay loam and clay loam. It has thin, patchy and very patchy clay films that are yellowish brown (10YR 5/4) and brown (7.5YR 5/4) and dark brown (10YR 4/4). In some profiles in the lower part of the B2t horizon and the C horizon are thin, patchy and very patchy silt coatings of pale brown (10YR 6/3) or light yellowish brown (10YR 6/4).

Wellston soils are adjacent to Berks, Muskingum, and Johnsburg soils. They are deeper to bedrock than Berks and Muskingum soils. Unlike Johnsburg soils, they lack a fragipan and lack gray mottles in the B horizon. Wellston soils lack the moderately thick, dark-colored A1 horizon, which the Neotoma soils have.

WlC—Wellston silt loam, 6 to 12 percent slopes. This sloping soil is on narrow ridgetops of the unglaciated uplands. Soil areas are elongated and irregularly shaped, and have short and convex slopes. They cover 2 to 20 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are some areas of gently sloping Wellston soils, and some areas of moderately eroded Wellston soils that have a less silty surface layer. These moderately eroded soils contain loose sandstone fragments, and in these areas some small gullies have formed. Also included are some areas of Johnsburg soils in small depressions, at the head of drainageways, and in narrow bands along drainageways, as well as in other less sloping areas. Other inclusions are a few small areas of Muskingum soils.

Erosion and slope are moderate limitations to the use of this soil for farming. Depth to bedrock and slope are limitations to nonfarm uses. Capability unit IIIe–5; woodland suitability group 2o1.

WlD—Wellston silt loam, 12 to 18 percent slopes. This moderately steep soil is on ridgetops of the unglaciated uplands. Soil areas are elongated and irregularly shaped and have short convex slopes. They cover 2 to 20 acres.

Included with this soil in mapping are a few areas of moderately eroded or severely eroded Wellston soils. Also included are a few areas of Neotoma soils and many areas of Berks and Muskingum soils, where 10 to 30 percent of the surface is covered by loose fragments of sandstone.

This soil is better suited to permanent vegetation than to cultivated crops. Most of the acreage is in forest or is reverting to forest. Severe erosion, slope, stoniness, and depth to bedrock are limitations to farm use and to most nonfarm uses. This soil is suited to some recreation uses. Capability unit IVe–5; woodland suitability group 2r1.

Westland Series

The Westland series consists of very poorly drained, nearly level soils that formed in loess or alluvium and outwash underlain by calcareous sand and gravel. These soils are on stream terraces in areas once covered by the Wisconsin and Illinoian glaciations. The native vegetation was hardwood forest intermixed with swamp grasses in many places. Elm, sycamore, pin oak, ash, and soft maple were dominant.

In a representative profile, in a cultivated area, the surface layer is 5 inches of very dark gray silt loam over 6 inches of black silt loam. The subsoil extends to a depth of 48 inches. The upper 8 inches is dark-gray sandy clay loam mottled with dark yellowish-brown; the next 7 inches is grayish-brown sandy clay loam mottled with gray and yellowish brown; the next 11 inches is gray sandy clay loam mottled with yellowish brown; and the lower 11 inches is dark-gray gravelly sandy loam mottled with yellowish brown and grayish brown. The substratum, to a depth of 62 inches, is brown loose sand and gravel mottled with yellowish brown and grayish brown.

The available water capacity is high in the naturally wet Westland soils. Permeability is slow to moderate in the solum and rapid in the substratum. Surface runoff is slow to ponded. The root zone is moderately deep to deep and is medium acid to neutral. These soils have a high content of organic matter.

Westland soils are used mainly for corn, soybeans, wheat, and grass-legume mixtures for hay and pasture. Only a small acreage is in permanent pasture or woodland.

Representative profile of Westland silt loam, overwash, in a cultivated field, 2¾ miles northeast of Hillsboro on State Route 138, 150 yards northeast of the intersection of Selph Road and State Route 138, and 125 feet east of State Route 138, in Liberty Township:

Ap—0 to 5 inches, very dark gray (10YR 3/1) silt loam; very dark grayish brown (10YR 3/2) when rubbed; moderate, medium, granular structure; very friable; many roots; neutral; abrupt, smooth boundary.

A12—5 to 11 inches, black (10YR 2/1) silt loam; very dark brown (10YR 2/2) when rubbed; moderate, medium subangular blocky structure; friable; common roots; 8 percent pebbles; neutral; abrupt, wavy broundary.

B21tg—11 to 19 inches, dark-gray (10YR 4/1) sandy clay loam; common, medium, distinct, dark yellowish-brown (10YR 4/4) mottles; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky; firm: common roots; thin, very patchy, dark-gray (10YR 4/1) clay films on ped faces; 10 percent pebbles; neutral; clear, wavy boundary.

B22tg—19 to 26 inches, grayish-brown (10YR 5/2) sandy clay loam; common, medium, distinct, gray (10YR 5/1) mottles and many, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, prismatic structure parting to weak, coarse, subangular blocky; firm; few roots; thin, patchy, dark-gray (10YR 4/1) clay films on ped faces; 5 percent pebbles; neutral; gradual, wavy boundary.

B23tg—26 to 37 inches, gray (10YR 5/1) sandy clay loam; many, coarse, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium and coarse, subangular blocky structure; friable; few roots; thin, very patchy, dark-gray (10YR 4/1) clay films on vertical ped faces; 5 percent pebbles; neutral; abrupt, smooth boundary.

B3g—37 to 48 inches, dark-gray (10YR 4/1) gravelly sandy loam; few, medium, distinct, yellowish-brown (10YR 5/6) mottles and many, medium, distinct, grayish-brown (10YR 5/2) mottles; massive; loose; 25 percent gravel; moderately alkaline; clear, wavy boundary.

C—48 to 62 inches, brown (10YR 5/3) sand and gravel; common, medium, distinct, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/6) mottles; single grained; loose; 40 percent pebbles and cobbles; moderately alkaline, calcareous; clear, smooth boundary.

The thickness of the solum and the depth to calcareous sand and gravel is 40 to 60 inches. The loess or silty alluvium in some profiles is 10 to 30 inches thick. The A horizons is neutral to medium acid, and the B2 and B3 horizon are neutral to moderately alkaline.

The A horizon is 10 to 18 inches thick. It is very dark gray (10YR 3/1), black (10YR 2/1), and very dark grayish brown (10YR 3/2), silt loam and silty clay loam.

The B and C horizons are commonly dark gray (10YR 4/1) and (N 4/0), gray (10YR 5/1), and (N 5/0), or grayish brown (10YR 5/2) and (2.5Y 5/2). They have mottles in hues of 10YR, value of 4 and 5, and chroma of 1 through 6. The matrix and mottle colors are reversed in some profiles. The B2t horizon is silty clay loam, clay loam, and sandy clay loam. In some profiles the lower part of the B2 horizon and the B3 horizon are gravelly. The B2 horizon has thin, patchy or very patchy clay films of dark gray (10YR 4/1) and (N 4/0), or very dark gray (10YR 3/1) and (N 3/0).

Westland soils are part of the drainage sequence that contains well drained Ockley soils, moderately well drained Thackery soils, and somewhat poorly drained Sleeth soils. Unlike Patton soils, Westland soils are underlain by sand and gravel. They differ from Sloan soils in having a more developed, more clayey B horizon, and they are not underlain by clayey lacustrine sediments, as are the Montgomery soils.

Ws—Westland silt loam, overwash. This nearly level soil is on stream terraces. It is in narrow bands along drainageways and in fan-shaped areas at the head of drainageways. It is commonly close to streams that flood periodically or in depressions near the base of more sloping soils. The soil areas are narrow to broad, elongated and in places irregularly shaped. They cover 3 to 30 acres.

This soil has the profile described as representative of the series. It is subject to more frequent flooding or ponding and siltation than Westland silty clay loam.

Included with this soil in mapping are Westland soils that have a finer textured surface layer.

This soil is well suited to crops. Very poor natural drainage, seepage, and ponding in some areas are the main limitations to farm use. Very poor natural drainage, a seasonal high water table, and ponding are severe limitations to nonfarm uses. Capability unit IIw–4; woodland suitability group 2w1.

Wt—Westland silty clay loam. This nearly level soil is on stream terraces. It is also in narrow bands along drainageways, in fan-shaped areas at the head of drainageways and, in some places, is close to streams that flood periodically, or in depressions near the base of more sloping soils. The soil areas are narrow to broad, elongated, and in places irregularly shaped. They cover 3 to 30 acres. Slopes are as much as 2 percent. This soil has a profile simliar to the one described as representative of the series, but the surface layer is finer textured. Because it has a finer textured surface layer, it is somewhat difficult to till. Unless tilled when the content of moisture is optimum, it tends to become cloddy.

Included with this soil in mapping are some areas of Westland soils that have a silty surface layer.

This soil is well suited to crops but requires artificial drainage for maximum production. Very poor natural drainage, a seasonal high water table, and ponding are

severe limitations to nonfarm uses. Capability unit IIw–4; woodland suitability group 2w1.

Williamsburg Series

The Williamsburg series consists of well-drained, nearly level to moderately steep soils that formed in loess or alluvium and stratified outwash. These soils are on stream terraces in areas where the glacial material is of Illinoian age, but the nearby streams begin in areas where the glacial material is of late Wisconsin age. The native vegetation was hardwood forest, in which beech, hickory, oak, and maple were dominant.

In a representative profile, in a cultivated area, the surface layer is brown silt loam 9 inches thick. The subsurface layer is yellowish-brown silt loam 3 inches thick. The subsoil extends to a depth of 65 inches. The upper 18 inches of the subsoil is yellowish-brown silt loam, silty clay loam, and loam. Next is 7 inches of strong-brown sandy clay loam that has yellowish-brown mottles, 5 inches of yellowish-brown sandy clay loam that has light yellowish-brown mottles, and 13 inches of yellowish-brown and dark yellowish-brown gravelly sandy loam. The lower 10 inches is yellowish-brown sandy clay loam that has light brownish-gray, strong-brown, and brown mottles. The substratum is dark yellowish-brown fine sandy loam between depths of 65 and 68 inches and is yellowish-brown and grayish-brown loam that has strong-brown, brown, and light brownish-gray mottles at a depth between 68 to 91 inches.

The available water capacity is medium in Williamsburg soils. Permeability is moderate, and surface runoff ranges from slow to rapid, depending on the slope. The root zone is moderately deep and is commonly medium acid to very strongly acid.

Williamsburg soils are used mainly for farm crops. The main crops are corn, soybeans, wheat, and grass-legume mixtures for hay and pasture. A small acreage is in permanent pasture or is wooded.

Representative profile of Williamsburg silt loam, 0 to 2 percent slopes, in a cultivated field, 3¾ miles east of Hillsboro on U.S. Highway 50, 0.6 mile north on Petersburg Road, and 330 yards north of the intersection of Petersburg Road and Carroll Lane, in Liberty Township:

Ap—0 to 9 inches, brown (10YR 4/3) silt loam; moderate, fine and medium, granular structure; friable; many roots; strongly acid; abrupt, smooth boundary.

A2—9 to 12 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, subangular blocky structure; friable; grayish-brown (10YR 5/2) organic-matter stains in isolated pockets and old root and worm channels; common roots; strongly acid; clear, wavy boundary.

B1—12 to 17 inches, yellowish-brown (10YR 5/6) silt loam; common, medium, faint, yellowish-brown (10YR 5/4) mottles; moderate, fine and medium, subangular blocky structure; friable; common roots; strongly acid; gradual, wavy boundary.

B21t—17 to 23 inches, yellowish-brown (10YR 5/6) silty clay loam; common, medium, faint, yellowish-brown (10YR 5/4) mottles; moderate, medium, subangular blocky structure; firm; few roots; thin, patchy, brown (7.5YR 4/4) clay films on vertical ped faces and thin, very patchy, brown (7.5YR 4/4) clay films on horizontal ped faces; common, fine, distinct, very dark brown (10YR 2/2) stains and concretions; 3 percent pebbles; very strongly acid; gradual, wavy boundary.

IIB22t—23 to 30 inches, yellowish-brown (10YR 5/6) loam; common, medium, faint, yellowish-brown (10YR 5/4) mottles; moderate, medium, subangular blocky structure; firm; few roots; thin, patchy, brown (7.5YR 4/4) clay films on vertical ped faces and thin, very patchy, brown (7.5YR 4/4) clay films on horizontal ped faces; common, fine, distinct, very dark brown (10YR 2/2) stains and concretions; 5 percent pebbles; very strongly acid; clear, wavy boundary.

IIB23t—30 to 37 inches, strong-brown (7.5YR 5/6) sandy clay loam; common, medium, faint, yellowish-brown (10YR 5/4) mottles; weak, medium, subangular blocky structure; friable; thin, very patchy, brown (7.5YR 4/4) clay films on ped faces; many, fine and medium, prominent, black (10YR 2/1) stains and concretions; 10 percent pebbles; strongly acid; clear, wavy boundary.

IIB31—37 to 42 inches, yellowish-brown (10YR 5/6) sandy clay loam; many, medium, distinct, light yellowish-brown (10YR 6/4) mottles; weak, medium, subangular blocky structure; friable; common, fine, distinct, very dark brown (10YR 2/2) stains and concretions; 15 percent pebbles; strongly acid; abrupt, wavy boundary.

IIB32—42 to 55 inches, yellowish-brown (10YR 5/6) and dark yellowish-brown (10YR 4/4) gravelly sandy loam; weak, medium and coarse, subangular blocky structure; very friable; 25 percent pebbles; medium acid; clear, wavy boundary.

IIB33—55 to 65 inches, yellowish-brown (10YR 5/4) sandy clay loam; few, fine, distinct, light brownish-gray (10YR 6/2) mottles and common, medium, distinct, strong-brown (7.5YR 5/6) and brown (7.5YR 4/4) mottles; weak, medium, subangular blocky structure; friable; common, fine and medium, distinct, black (10YR 2/1) stains and concretions; 15 percent pebbles; medium acid; abrupt, wavy boundary.

IIC1—65 to 68 inches, dark yellowish-brown (10YR 4/4) fine sandy loam; massive; loose; slightly acid; abrupt, wavy boundary.

IIC2—68 to 80 inches, yellowish-brown (10YR 5/4) loam; common, fine and medium, distinct, strong-brown (7.5YR 5/6) and brown (7.5YR 4/4) mottles and few, fine, distinct, light brownish-gray (10YR 6/2) mottles; moderate, thick, platy structure; firm; common, fine, distinct, very dark brown (10YR 2/2) stains and concretions; 10 percent pebbles; neutral; clear, wavy boundary.

IIC3—80 to 91 inches, grayish-brown (2.5Y 5/2) loam; common, medium and coarse, prominent, strong-brown (7.5YR 5/6) mottles; massive; firm; 15 to 20 percent pebbles; mildly alkaline, calcareous.

The solum is 60 to 90 inches thick. The loess or silty alluvium is 12 to 24 inches thick. The solum is medium acid to very strongly acid in the A and B2t horizons and strongly acid to neutral in the B3 horizon.

The Ap horizon has a hue of 10YR, value of 4 or 5, and chroma of 2 or 3. In undisturbed profiles the A1 horizon is very dark grayish brown (10YR 3/2) or dark gray (10YR 4/1) and 2 to 4 inches thick. The A2 horizon has a hue of 10YR, value of 4 through 6, and chroma of 3 or 4. It is 2 to 6 inches thick.

The B2t and B3 horizons have a hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 through 6. They are silty clay loam, loam, clay loam, and sandy clay loam. In the B2t horizon clay films are thin and medium and patchy and very patchy and have a hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. In some profiles, silt coatings are on ped faces in the upper part of the B2t horizon. The silt coatings are light yellowish brown (10YR 6/4), pale brown (10YR 6/3), brown (7.5YR 5/4), and light brown (7.5YR 6/4).

The C horizon is dark yellowish-brown (10YR 4/4), yellowish-brown (10YR 5/4 and 5/6), brown (10YR 4/3 and 5/3), or grayish-brown (10YR 5/2). It is fine sandy loam, loam, clay loam, sandy clay loam, and gravelly clay loam and is stratified with these textures or it has thin strata of sand or clay in some profiles. The C horizon is medium acid to mildly alkaline. Calcareous sand and gravel are at a depth of 7 to 10 feet in some profiles.

Williamsburg soils are part of the drainage sequence that includes moderately well drained Sardinia soils, somewhat

poorly drained Fitchville soils, and very poorly drained, dark-colored Patton soils. Williamsburg soils do not have a fragipan, which is a characteristic of Otwell soils. The solum of Williamsburg soils is more acid than that of Ockley and Genesee soils. Williamsburg soils do not have an underlying layer of sand and gravel at a depth of 40 to 60 inches, which is a characteristic of Ockley soils.

WvA—Williamsburg silt loam, 0 to 2 percent slopes. This nearly level soil is on slightly convex stream terraces. The soil areas are moderately broad but in many places are elongated. They range from 3 to 35 acres in size but generally are 5 to 15 acres. This soil commonly is between the more sloping soils and the lower areas on terraces or flood plains. It has the profile described as representative of the series.

Included with this soil in mapping are a few areas of Sardinia and Fitchville soils that are in slight depressions, at the head of drainageways, and in narrow bands along drainageways. Also included are a few areas of Williamsburg soils that have a surface layer of loam that contains a small amount of gravel.

This soil is well suited to nursery crops, truck crops, and sod production. Although in some areas, this soil is subject to periodic seepage and deposition from adjacent more sloping areas, in most areas it has few limitations to use for farming. It has few limitations to nonfarm uses. Capability unit I–1; woodland suitability group 1o1.

WvB—Williamsburg silt loam, 2 to 6 percent slopes. This gently sloping soil is on slightly convex areas of stream terraces. Some areas of the soil are moderately broad, but most are elongated. They cover 3 to 15 acres. The soil commonly is between more sloping soils and lower areas on terraces and flood plains.

Included with this soil in mapping are some areas of Williamsburg soils that have a thicker surface layer of silt loam because they receive more runoff and more deposition of soil material. Also included are moderately eroded Williamsburg soils that have a surface layer of loam or clay loam that contains a small amount of gravel. Some areas of Sardinia and Fitchville soils in slight depressions at the head of drainageways and in narrow bands along drainageways are also included.

The hazard of erosion is moderate, and some measures for controlling erosion are needed if this soil is cultivated. The soil is suited to nursery crops, truck crops, tobacco, and sod production. Slope is a limitation to some nonfarm uses. Capability unit IIe-1; woodland suitability group 1o1.

WvC—Williamsburg silt loam, 6 to 12 percent slopes. This sloping soil is on stream terraces. Areas of the soil are narrow, long, and irregularly shaped and range from 5 to 25 acres in size. Slopes are mainly short to medium. The soil is near Ockley soils but is at a higher elevation. It has a profile similar to the one described as representative of the series, but part of the original surface layer has been removed by erosion.

Included with this soil in mapping are moderately eroded Williamsburg soils and moderately steep Williamsburg soils. Also included are areas of severely eroded Williamsburg soils that have a surface layer of loam or clay loam, which contains much gravel. Some shallow, crossable gullies are in these areas. Some areas of Ockley soils, less sloping Sardinia and Fitchville soils, and dark-colored Westland soils in depressions at the head of drainageways and in narrow bands along drainageways are also included.

Slope and moderate erosion are limitations to the use of this soil for farming. Also, the soil tends to be droughty. Slope is a limitation to nonfarm uses. Capability unit IIIe–1; woodland suitability group 1o1.

Xenia Series

The Xenia series consists of moderately well drained, nearly level to gently sloping soils that formed in loess and glacial till. These soils are on moraines and till plains. The native vegetation was hardwoods, in which maple, beech, oak, and hickory were dominant.

In a representative profile, in a cultivated area, the surface layer is brown silt loam 8 inches thick. The subsurface layer, to a depth of 11 inches, is yellowish-brown silt loam. The subsoil extends to a depth of 54 inches. The upper 4 inches is yellowish-brown silt loam. The next 7 inches is yellowish-brown silty clay loam. The next 6 inches is yellowish-brown silty clay loam mottled with grayish brown and light gray. The next 8 inches is yellowish-brown clay loam mottled with grayish brown and a lighter shade of yellowish brown. The lower 18 inches is yellowish-brown clay loam mottled with gray and a lighter shade of yellowish brown. The substratum, to a depth of 65 inches, is yellowish-brown and gray loam.

The available water capacity is medium to high in Xenia soils. Permeability is moderately slow, and surface runoff is slow to medium. The root zone is deep and commonly medium acid to strongly acid.

Xenia soils are used mainly for corn, soybeans, wheat, and grass-legume mixtures for hay and pasture. A small part is in permanent pasture or woodland.

Representative profile of Xenia silt loam in an area of Celina-Xenia silt loams, 2 to 6 percent slopes, in a cultivated field, 0.2 mile west of New Petersburg on Bectal Road, and 75 yards south-southwest of Bectal Road, in Paint Township:

Ap—0 to 8 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; many roots; slightly acid; abrupt, smooth boundary.

A2—8 to 11 inches, yellowish-brown (10YR 5/4) silt loam; weak, thick, platy structure; friable; common roots; dark grayish-brown (10YR 4/2) organic stains in old root channels, medium acid; clear, wavy boundary.

B1—11 to 15 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine and medium, subangular blocky structure; friable; few roots; few, fine, distinct, black (10YR 2/1) stains; medium acid; clear, wavy boundary.

B21t—15 to 22 inches, yellowish-brown (10YR 5/4) silty clay loam; moderate, fine and medium, subangular blocky structure; firm; few roots; thin, patchy, dark yellowish-brown (10YR 4/4) clay films on vertical ped faces and thin, very patchy, dark yellowish-brown (10YR 4/4) clay films on horizontal ped faces; thin, very patchy, pale-brown (10YR 5/3) silt coatings on vertical ped faces; few, fine, distinct, black (10YR 2/1) stains; strongly acid; clear, wavy boundary.

B22t—22 to 28 inches, yellowish-brown (10YR 5/4) silty clay loam; common, fine, distinct, grayish-brown (10YR 5/2) and light-gray (10YR 6/1) mottles; moderate, fine and medium, subangular blocky structure; firm; few roots; thin, patchy, dark yellowish-brown (10YR 4/4) clay films on vertical and horizontal ped faces; thin, patchy, pale-brown (10YR 6/3) silt coatings on vertical and horizontal ped faces; common, fine,

distinct, black (10YR 2/1) stains; 5 percent pebbles; medium acid; clear, wavy boundary.

IIB23t—28 to 36 inches, yellowish-brown (10YR 5/4) clay loam; common, medium, distinct, grayish-brown (10YR 5/2) mottles and common, medium, faint, yellowish-brown (10YR 5/6) mottles; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; firm; few roots; thin, very patchy, dark yellowish-brown (10YR 4/4) clay films on vertical ped faces; thin, patchy, pale-brown (10YR 6/3) silt coatings on vertical ped faces; many, medium, distinct, black (10YR 2/1) stains and concretions; 5 percent pebbles; medium acid; clear, wavy boundary.

IIB3—36 to 54 inches, yellowish-brown (10YR 5/4) clay loam; many, medium, distinct, yellowish-brown (10YR 5/8) mottles and common, fine, distinct, gray (10YR 6/1) mottles; weak, coarse, subangular blocky structure; friable to firm; common, fine, distinct, black (10YR 2/1) stains; 10 percent pebbles; slightly acid at 39 inches and neutral at 50 inches; clear, wavy boundary.

IIC—54 to 65 inches, yellowish-brown (10YR 5/6) and gray (10YR 5/1) loam; massive; firm, compact; common, fine, distinct, black (10YR 2/1) stains; 10 percent pebbles; mildly alkaline, calcareous.

The thickness of the solum and depth to calcareous glacial till is 42 to 60 inches. The mantle of loess is 22 to 40 inches thick. The A2, B1, and B2 horizons range from medium acid to strongly acid, and the B3 horizon is slightly acid to mildly alkaline. The Ap horizon is dark grayish brown (10YR 4/2) and brown (10YR 4/3 and 5/3). In undisturbed areas, the A1 horizon is very dark grayish brown (10YR 3/2) or very dark brown (10YR 2/2) 1 to 4 inches thick.

The A2 and B1 horizons are mainly yellowish brown (10YR 5/4 and 5/6). The B1 horizon is silty clay loam, clay loam, and heavy silt loam. The B2 horizon has hue of 10YR, value of 4 and 5, and chroma of 4 and 6 and has mottles of low chroma within the upper 10 inches and at a depth of 15 to 24 inches from the soil surface. This horizon is heavy silt loam, silty clay loam, and clay loam 20 to 45 inches thick. The B3 horizon has hue of 10YR, value of 4 or 5, and chroma of 4 and 6.

Xenia soils are part of a drainage sequence that includes well drained Russell soils, somewhat poorly drained Fincastle soils, and very poorly drained, dark-colored Brookston soils. They are adjacent to the well-drained Hennepin and Miamian soils in many areas. Xenia soils lack the fragipan in the Rossmoyne soils. They have a thicker mantle of loess and are deeper to calcareous glacial till than Celina soils, and they have a less clayey B horizon than Loudon soils, and they lack underlying shale bedrock which is a characteristic of those soils.

XeB—Xenia silt loam, 2 to 6 percent slopes. This gently sloping soil is on narrow to broad ridges, and along the drainageways of dissected uplands. The soil areas are oval or rounded, irregularly shaped, or elongated. They cover 3 to 22 acres. Slopes are mainly slightly convex, but some are concave. The length of the slopes varies considerably. This soil is adjacent to and closely associated with Miamian, Russell, Fincastle, and Brookston soils. The hazard of erosion is moderate.

Included with this soil in mapping are a few small areas of moderately eroded Xenia soils, and a few areas of Russell and Miamian soils. Some areas of Fincastle soils and the dark-colored Brookston soils are at the head of and along drainageways. Some posts that are shallower to carbonates and have a thinner capping of silt are also included.

Some measures for controlling erosion are necessary if this soil is used for cultivated crops. Moderately slow permeability, slope, and a seasonal high water table are limitations to some nonfarm uses. Capability unit IIe–1; woodland suitability group 1o1.

Formation and Classification of the Soils

In the following pages the factors of soil formation and the processes of soil formation in Highland County are discussed. The current system of soil classification is explained and the soil series placed in higher categories of the current classification system.

Factors of Soil Formation

Soils are the products of soil forming processes acting on materials deposited or accumulated by geologic forces. The important factors in soil formation are parent material, climate, relief, living organisms, and time.

Climate and living organisms, particularly vegetation, are the active forces in soil formation. Their effect on parent material is modified by relief and by the length of time the parent material has been acted upon. The relative importance of each factor differs from place to place. In places one factor may dominate and, in extreme cases, determine most of the soil properties, but normally the interaction of all five factors determines what kind of soil develops in any given place.

Parent material

The soils of Highland County formed in several kinds of parent material. These materials are glacial till, outwash, weathered products of sedimentary bedrock, loess, lacustrine deposits, and alluvium derived from these various materials. Several soils formed in combinations of the materials named.

Most of the county was covered by glaciers during several stages of the Pleistocene Age. At present the material at the surface in the northern part of the county is of Wisconsin Age, but it is of Illinoian Age in the western, central, and southern parts. In the extreme southeastern part of the county, in the Allegheny Plateau, glacial deposits are lacking. The area that is now glaciated was probably a nearly level plain where bedrock of limestone and shale was near the surface. Because the thickness of the glacial deposits and loess were variable, the depth to bedrock now varies considerably within short distances.

In Highland County there are many different kinds of sedimentary rocks, among which are calcareous limestone and shale of the Ordovician System in the western part of the county; calcareous limestone and shale, and dolomitic limestone of the Silurian System in the central part; and extremely acid shale and sandstone of the Devonian and Mississippian Systems in the extreme east-southeastern part of the county. The soils in about one-third of the series in the county formed partly or completely in residuum weathered from bedrock or have a classification that has been affected by depth of bedrock.

Opequon and Gasconade soils formed entirely in material weathered from limestone bedrock. Milton and Millsdale of the Wisconsin glaciated area and Boston, Grayford, and Edenton of the Illinoian glaciated area formed in a combination of materials, among which are loess, till, and material weathered from bedrock. Bratton and Nicholson soils of the unglaciated areas formed in loess and in residuum weathered from limestone. Loudon and Jessup soils also formed in loess and Illinoian till,

but they formed in material derived from residuum weathered from calcareous shale rather than limestone. Beasley, Lawshe, and Guernsey soils formed in residuum or colluvium, or both. The residuum or colluvium, consists of calcareous shale or limestone. Colyer, Trappist, and other soils formed in the acid residuum weathered from shale, and Berks, Muskingum, Wellston, and other soils formed in the residuum weathered from sandstone.

Glacial drift is the most extensive parent material in this county, and in this survey, it includes outwash sand and gravel. Several of the soils formed in till, which was capped with loess up to 18 inches thick, on the end moraine in the extreme northeastern part of Highland County. Miamian, Celina, and Brookston soils are examples of those that formed in till and in less than 18 inches of loess. Soils that formed in till overlain by 18 to 40 inches of loess are Russell, Xenia, Fincastle, and other soils in the Wisconsin glaciated areas. Cincinnati, Rossmoyne, Avonburg, and Clermont soils are examples of those that formed in till, of Illinoian Age, over which was 18 to 40 inches of loess capping. In unglaciated areas the loess capping is mainly less than 18 inches thick but on Nicholson, Muse, and some other soils, it is more than 18 inches thick.

Outwash sand and gravel were deposited by glacial melt water that flowed in the many streams, or they occur in the form of glacial kames and eskers. Much of this coarse material was fairly well sorted, and then most of it was covered by medium textured to moderately fine textured material, mainly loamy outwash and loess. Ockley, Wea, Westland, and Sleeth soils of the Wisconsin glaciated areas and Negley, Otwell, Haubstadt, and Dubois soils of the Illinoian glaciated areas formed in those materials. Fox, Casco, and Warsaw soils formed in sorted coarse sand and gravel. Soils that formed in medium textured to moderately fine textured materials, mainly loamy outwash and loess, are Williamsburg, Sardinia, Fitchville, and other soils.

Only small areas of lacustrine materials or lake-bottom sediments are in the county. The silt and clay lacustrine deposits were the parent material in which the subsoil of Montgomery, Patton, McGary, and Markland soils formed. The largest areas of these deposits occurred in the depressional, poorly drained area just south of Marshall and in the area of Beech Flats in eastern Highland County along the Pike County line.

Alluvial deposits left by floodwater are the youngest parent materials of soils in the county. These materials accumulate where fresh sediment is added by floods. This sediment was derived mainly from the surface layer of the soil in the surrounding higher areas. The Genesee, Eel, Sloan, and Ross soils formed in deep loamy deposits, and have little or no soil horizon development. These soils are fertile and neutral to calcareous.

Climate

The climate throughout Highland County is uniform enough that, by and large, differences in climate have not greatly contributed to differences in the soils. During the formation of the soils, it was favorable to both physical and chemical weathering of parent materials and to biological activity.

Rainfall has been enough for the adequate percolation of water so that leaching of carbonates to moderate or greater depth has taken place. Carbonates have been leached to a depth of 2 to 3½ feet in Miamian and Celina soils, which formed in Wisconsin age till, but to a depth of 6 to 10 feet in Cincinnati and Rossmoyne soils, which formed in older Illinoian till. Frequency of rainfall has been favorable to the translocation of clay minerals and the development of soil structure. Examples are Brookston, Jessup, and Fox soils.

The range in temperature has favored both physical change and chemical weathering of parent material. Freezing and thawing has aided in the development of soil structure. Warm summer temperatures have favored chemical reactions in the weathering of primary minerals.

Both rainfall and temperature have been favorable to plant growth and the subsequent accumulation of organic matter in all the soils.

Relief

Because of the effect of relief, different soils may form in the same kind of parent material. A comparison of the Celina, Crosby, and Brookston soils, all of which formed in glacial till, shows how relief has affected their formation. Celina soils are well drained and have a moderately thick solum because they generally formed where the relief was not so steep that the soil material eroded away before soil could form and where relief was not so nearly level that water could not run off. The Crosby soils are somewhat poorly drained and nearly level because they formed in areas where runoff was slow. The nearby Brookston soils are very poorly drained and dark colored because they formed in swales where organic residue accumulated and the water table was high most of the year.

In the morainic areas of the county, Miamian soils that occur with Celina soils on the steeper side slopes are dominant. On the till plains, the nearly level to gently undulating Brookston soils are dominant.

Living organisms

The vegetation at the time of settlement in Highland County was hardwood forest where oak, hickory, yellow-poplar, and ash were most numerous. There were grassy clearings on the well-drained sites and in marshy openings in the poorly drained swales.

The soils that formed in the forested areas are acid and moderate in natural fertility. Examples are Cincinnati, Celina, Jessup, and other soils. The soils that formed in the well-drained grassy clearings are dark colored, less acid, and more fertile. An example is Dana soils. The soils that formed in marshy swales are very poorly drained, dark colored, and fertile. Examples are Patton, Westland, and Brookston soils.

Small animals, insects, worms, and roots make the soil more permeable by making channels in it. Animals mix the soil materials and contribute organic matter in the process as well as after death. Wormholes or worm casts are plentiful in the highly organic surface layer of the Dana soils. Crawfish channels are numerous in the more poorly drained soils. These are Clermont (fig. 11), Avonburg, Blanchester, and other soils.

Man also affects the formation of soil by plowing, planting, and introducing plants. In some areas the formation of soils has been affected by drainage, irrigation, or removal of soil material for construction purposes.

Figure 11.—Area of Clermont silt loam where crawfish activity is evident.

The use of lime and fertilizer changes the chemistry of the soils. Each of these activities in its own way affects the future development of the soil.

Time

Time is needed for the other soil-forming factors to produce their effects. The age of a soil is indicated, to some extent, by the degree of development of its profile, but in many places, the factors other than time that have most affected the formation of soils are parent material that weathers slowly and relief that is steep.

Age of parent materials of the soils in the county may be separated into four broad geologic time periods. The oldest is the residuum that weathered from sedimentary bedrock in the southeastern part of the county. The sedimentary material was deposited in lakes and seas early in the geologic history of Highland County. The soils that formed in these materials show various degrees of development because of the influence of parent materials, hilly topography, and other soil-forming factors. The soils in this area are Colyer, Trappist, Berks, Muskingum, Opequon, Nicholson, and other soils.

The next oldest materials are those deposited by the Illinoian glaciation about 100,000 to 300,000 years ago. The surface of soils that formed in Illinoian till has been modified by a more recent cover of loess. These are Cincinnati, Rossmoyne, Clermont, Blanchester, Boston, Grayford, and other soils.

The parent materials of Wisconsin Age are younger than the materials of Illinoian Age or about 10,000 to 30,000 years old. The Miamian, Russell, Celina, Crosby, Brookston, and other soils of Wisconsin Age are weathered and leached to a depth of 2 to 3½ feet, but the soils that formed in material of Illinoian Age are weathered and leached to a depth of 6 to 10 feet or more.

The youngest materials of the county were deposited along present flood plains that receive fresh alluvium from periodic flooding. The Genesee, Eel, Shoals, Algiers, Ross, and other alluvial soils are so young they show little or no differentiation of horizons.

Processes of Soil Formation

Most of the soils in Highland County have a relatively strong profile development. The processes of soil formation have produced distinct changes in the material in which the soils formed or derived. These soils are on uplands and on terraces along the major valleys. A few soils, mainly on flood plains, are only slightly modified from the parent material.

All the factors of soil formation act in unison to control the processes of horizonation (*12*). These processes are four kinds; addition, removal, transfer, and transformation. Some of these changes promote horizon differentiation, but others retard or obliterate differences that are already present.

In this county the most evident addition to the soil is organic matter. Soils that formed under deep-rooted grasses or where a high water table has restricted decomposition of organic matter have a deep, dark-colored surface layer. The surface layer is high in organic matter, has good structure, and has base saturation that exceeds 50 percent. These properties describe the dark surface layer in Montgomery or Brookston soils and in other soils.

On most soils some organic matter accumulates as a thin surface mat. This dark layer is generally obliterated by cultivation, but severe erosion may remove all evidence of this layer.

Leaching of carbonates from calcareous parent materials is one of the most significant losses that precedes many other chemical changes in the solum. Most of the glacial till in the county has a high carbonate content. In most of the soils leaching has removed carbonates to a depth of 2 or more feet and the upper 2 feet or more is now acid. Other minerals in the soil are subject to the same chemical weathering, but their resistance is higher and removal is slower. After the carbonates have been removed, the alteration of biotite, feldspar, and other minerals results in changes of color within the profile. Free iron oxides are produced that may be segregated by a fluctuating high water table. Thus the gray colors and mottling in Brookston and other soils is produced. If there is no seasonal high water table, the brownish colors that have stronger chroma or redder hue than those in the C horizon develop.

The transfer of clay from the A horizon to the ped surfaces in the B horizon takes place because of the seasonal wetting and drying of the soil profile. The fine clay becomes suspended in percolating water as it moves through the surface layer and is carried downward to the subsoil. There, the fine clay is deposited on the ped surfaces by drying or by precipitation resulting from free carbonates. Because of this transfer of fine clay, there are patchy to nearly continuous clay films on ped surfaces in the B horizon of Miamian, Celina, and other soils.

The transformation of mineral compounds takes place in most soils. The results are most apparent if the development of horizons is not affected by rapid erosion or by accumulation of material at the surface. The primary silicate minerals are weathered chemically to produce secondary minerals, mainly those of the layer-lattice silicate clays. Most of the layer-lattice clays remain in the soil profile, but clay from the A horizon is transferred to deeper horizons.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationships to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First, through classification, and then through use of soil maps, we can apply our knowledge to specific fields and other tracts of land.

Thus, in classification, soils are placed in narrow classes that are used in detailed soil surveys so that knowledge about the soils can be organized and applied to managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. They are placed in broad classes of more general categories to facilitate study and comparison in large areas, such as countries and continents.

The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965.[5]

[5] Unpublished working document used in the Soil Conservation Service: "Soil Taxonomy of the National Cooperative Soil Survey." Copy available in the SCS State office.

Under the current system of classification, six categories are recognized. Beginning with the broadest and the most inclusive, these are the order, the suborder, the great group, the subgroup, the family, and the series. In this system, the criteria used as a basis for classification are soil properties that are observable and measurable. These properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped together. Most of the classes of the current system are briefly defined in the following paragraphs. The family, subgroup, and order for each soil series in the county, under the current classification, are shown in table 9. The suborder and great group are not shown separately as they are formative elements in the naming of the subgroups.

Order.—Ten soil orders are recognized in the current system. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of the soils. Two exceptions are Entisols and Histosols, which occur in many different climates. Five soil orders are represented in Highland County. They are Entisols, Inceptisols, Mollisols, Alfisols, and Ultisols.

Entisols are mineral soils either without natural genetic horizons or with only the beginning of horizons. The Entisols in this county are Algiers, Shoals, and Stonelick series. The Algiers soils consists of recent alluvium overlying a buried profile. The Shoals and Stonelick soils also formed in alluvium.

Inceptisols are mineral soils in which horizons have started to develop but which do not have an accumulation of illuvial clay in the B horizons.

Mollisols are mineral soils that have a dark-colored surface layer 10 inches or more thick that has a base saturation of more than 50 percent.

Alfisols are mineral soils that have a B horizon of clay accumulation and a base saturation of more than 35 percent within 50 inches depth from the top of the Bt horizon.

Ultisols consist of mineral soils with horizons of clay accumulation, argillic horizons. The Ultisols are strongly acid to greater depths than the Alfisols, and have less than 35 percent base saturation at a depth of 50 inches below the top of the argillic horizon or to a depth of 30 inches below the top of a fragipan, if one occurs in the soil.

Suborder.—Each order is divided into suborders, mainly on the basis of those soil characteristics that produce classes having the greatest genetic similarity. The soil properties used to separate suborders are mainly those that indicate the presence or absence of a seasonal high water table or other differences resulting from the climate or vegetation.

Great group.—Suborders are separated into groups according to the presence or absence of genetic horizons and the arrangements of these horizons. The horizons used to make separations are those in which clay, iron, or humus have accumulated, or those that have pans that interfere with the growth of roots or the movement of water. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium) and the like.

Subgroup.—Great groups are divided into subgroups, one representing the central, or typic, segment of a group, and others, called intergrades, that have properties of one

TABLE 9.—*Classification of the soils*

Series	Family	Subgroup	Order
Algiers [1]	Fine-loamy, mixed, nonacid, mesic	Aquic Udifluvents	Entisols.
Atlas	Fine, montmorillonitic, mesic, sloping	Aeric Ochraqualfs	Alfisols.
Avonburg	Fine-silty, mixed, mesic	Aeric Fragiaqualfs	Alfisols.
Beasley	Fine, mixed, mesic	Typic Hapludalfs	Alfisols.
Berks	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Blanchester	Fine-silty, mixed, mesic	Typic Ochraqualfs	Alfisols.
Boston	Fine-silty, mixed, mesic	Typic Fraguidalfs	Alfisols.
Bratton	Fine, mixed, mesic	Typic Hapludalfs	Alfisols.
Brookston [1]	Fine-loamy, mixed, mesic	Typic Argiaquolls	Mollisols.
Cana	Fine-loamy, mixed, mesic	Aquic Hapludults	Ultisols.
Casco	Fine-loamy over sandy or sandy skeletal, mixed, mesic	Typic Hapludalfs	Alfisols.
Celina	Fine, mixed, mesic	Aquic Hapludalfs	Alfisols.
Cincinnati	Fine-silty, mixed, mesic	Typic Fragiudalfs	Alfisols.
Clermont	Fine-silty, mixed, mesic	Typic Ochraqualfs	Alfisols.
Colyer [1]	Clayey-skeletal, mixed, mesic	Lithic Dystrochrepts	Inceptisols.
Crosby	Fine, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Dana	Fine-silty, mixed, mesic	Typic Argiudolls	Mollisols.
Dubois	Fine-silty, mixed, mesic	Aeric Fragiaqualfs	Alfisols.
Edenton	Fine, mixed, mesic	Typic Hapludalfs	Alfisols.
Eel	Fine-loamy, mixed, nonacid, mesic	Aquic Udifluvents	Entisols.
Fincastle	Fine-silty, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Fitchville	Fine-silty, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Fox	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Typic Hapludalfs	Alfisols.
Gasconade	Clayey-skeletal, mixed, mesic	Lithic Hapludolls	Mollisols.
Genesee	Fine-loamy, mixed, nonacid, mesic	Typic Udifluvents	Entisols.
Grayford	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Guernsey	Fine, mixed, mesic	Aquic Hapludalfs	Alfisols.
Haubstadt	Fine-silty, mixed, mesic	Aquic Fragiudalfs	Alfisols.
Hennepin	Fine-loamy, mixed, mesic	Typic Eutrochrepts	Inceptisols.
Hickory [1]	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Jessup	Fine, illitic, mesic	Typic Hapludalfs	Alfisols.
Johnsburg	Fine-silty, mixed, mesic	Aquic Fragiudults	Ultisols.
Kendallville	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Lawshe	Fine, mixed, mesic	Aquic Hapludolls	Mollisols.
Loudon	Fine, illitic, mesic	Aquic Hapludalfs	Alfisols.
Markland	Fine, mixed, mesic	Typic Hapludalfs	Alfisols.
McGary	Fine, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Miamian	Fine, mixed, mesic	Typic Hapludalfs	Alfisols.
Millsdale	Fine, mixed, mesic	Typic Argiaquolls	Mollisols.
Milton	Fine, mixed, mesic	Typic Hapludalfs	Alfisols.
Montgomery [1]	Fine, mixed, mesic	Typic Haplaquolls	Mollisols.
Muse	Clayey, mixed, mesic	Typic Hapludults	Ultisols.
Muskingum	Fine-loamy, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Negley	Fine-loamy, mixed, mesic	Typic Paleudalfs	Alfisols.
Neotoma	Loamy-skeletal, mixed, mesic	Ultic Hapludalfs	Alfisols.
Nicholson	Fine-silty, mixed, mesic	Typic Fragiudalfs	Alfisols.
Ockley	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Opequon	Clayey, mixed, mesic	Lithic Hapludalfs	Alfisols.
Otwell	Fine-silty, mixed, mesic	Typic Fragiudalfs	Alfisols.
Patton [1]	Fine-silty, mixed, mesic	Typic Haplaquolls	Mollisols.
Peoga	Fine-silty, mixed, mesic	Typic Ochraqualfs	Alfisols.
Philo	Coarse-loamy, mixed, mesic	Fluvaquentic Dystrochrepts	Inceptisols.
Ross	Fine-loamy, mixed, mesic	Cumulic Hapludolls	Mollisols.
Rossmoyne	Fine-silty, mixed, mesic	Aquic Fragiudalfs	Alfisols.
Russell	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Sardinia	Fine-silty, mixed, mesic	Aquic Hapludalfs	Alfisols.
Shoals	Fine-loamy, mixed, nonacid, mesic	Aeric Fluvaquents	Entisols.
Sleeth	Fine-loamy, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Sloan	Fine-loamy, mixed, mesic	Fluvaquentic Haplaquolls	Mollisols.
Stonelick	Coarse-loamy, mixed, calcareous, mesic	Typic Udifluvents	Entisols.
Thackery	Fine-loamy, mixed, mesic	Aquic Hapludalfs	Alfisols.
Trappist	Clayey, mixed, mesic	Typic Hapludults	Ultisols.
Tuscarawas	Fine-loamy, mixed, mesic	Aquic Hapludults	Ultisols.
Warsaw	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Typic Argiudolls	Mollisols.
Wea	Fine-loamy, mixed, mesic	Typic Argiudolls	Mollisols.

See footnotes at end of article.

TABLE 9.—*Classification of the soils*—Continued

Series	Family	Subgroup	Order
Wellston	Fine-silty, mixed, mesic	Ultic Hapludalfs	Alfisols.
Westland	Fine-loamy, mixed, mesic	Typic Argiaquolls	Mollisols.
Williamsburg	Fine-loamy, mixed, mesic	Ultic Hapludalfs	Alfisols.
Xenia	Fine-silty, mixed, mesic	Aquic Hapludalfs	Alfisols.

[1] In Highland County, the following soils are taxadjuncts to the series for which they are named: Algiers soils are mottled at a depth of less than 20 inches, which is outside the range defined for the series. Brookston soils have more clay in the upper part of the B horizon than is defined as the range for the series. These taxadjuncts are classified in the fine, mixed, mesic family of Typic Argiaquolls. Colyer soils have less clay in the fine earth fraction of the profile than is defined as the range for the series. These taxadjuncts are classified in the loamy-skeletal, mixed, mesic family of Lithic Dystrochrepts. Hickory soils have a thinner solum and are shallower to carbonates than is defined as the range for the series. Montgomery soils show some clay movement into the B horizon, which is outside the range defined for the series. Patton soils have a thicker solum than is defined as the range for the series.

great group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. Examples are Typic Hapludalfs and Aquic Hapludolls.

Family.—Families are separated within a subgroup primarily on the basis of properties important to the growth of plants or to the behavior of soils if used for engineering. Among the properties considered are texture, reaction, soil temperature, mineralogy, thickness of horizons, and consistence.

Series.—The series has the narrowest range of characteristics of the categories in the classification system. It is defined in the section "How This Soil Survey Was Made." A detailed description of each soil series in the county is given in the section "Descriptions of the Soils."

Some of the soils in this county do not fit in a series that has been recognized in the classification system, but recognition of a separate series would not serve a useful purpose. Such soils are named for the series they strongly resemble because they differ from those series in ways too small to be of consequence in interpreting their usefulness or behavior. Soil scientists designate such soils taxadjuncts to the series for which they are named.

In this survey, soils named in the Algiers, Brookston, Colyer, Hickory, Montgomery, and Patton series are taxadjuncts to those series.

Laboratory Data

In table 10 laboratory data are given for 17 soil series in Highland County. The profile descriptions for representative soils of these series are in the section, "Descriptions of the Soils." The data given in table 10 were obtained by laboratory analyses at the Agronomy Department, Ohio Agricultural Research and Development Center (OARDC), Columbus, Ohio. The soils analyzed were selected to help in their proper classification and interpretations.

Published and unpublished laboratory data are available for nearly all the soil series in Highland County. Published laboratory data are available in the soil surveys for nearby counties. Unpublished data are on file at the Agronomy Department, OARDC, Columbus, Ohio; the Ohio Department of Natural Resources, Division of Lands and Soil, Columbus, Ohio; and the Soil Conservation Service, State Office, Columbus, Ohio.

In the following paragraphs, some of the procedures used to obtain the data presented in table 10 are listed.

Particle-size distribution data were obtained by the pipette method outlined by Steele and Bradfield (*13*), but using sodium hexametaphosphate as the dispersing agent and a 10-gram soil sample. The sand fractions were determined by sieving. The fine silt and coarse clay were determined by sedimentation, and the fine clay was determined by sedimentation in a centrifuge. Coarse silt was obtained by subtracting sand, fine silt, and clay from the total sample.

All pH measurements were made using a 1:1 soil-water ratio. The percentage of organic matter was determined by a dry combustion method. Calcium carbonate equivalent was determined by the gasometric method by Dreimanis (*6*).

Extractable acidity (titratable aluminum and hydrogen aluminum) was determined by the triethanolamine method (*10*). Extractable calcium and magnesium in this solution were determined by the EDTA titration method (*4*). The extractable potassium in this solution was determined with a flame photometer (*10*). Extractable bases were extracted with a neutral solution of ammonium acetate.

General Nature of the County

Highland County is an area of great contrast in soils, geology, relief, intensity of agriculture, and density of forest.

According to the U.S. Census of Agriculture, in 1969, in Highland County, the acreage in 2,015 farms totaled 307,106 acres or 87.4 percent of the county, an increase of 2 percent over the acreage in 1964. The average size of farms increased slightly from 150.1 acres in 1964 to 152.4 acres in 1969. In 1969 the percentage of farms operated by owners or part owners was 88.8.

Most farm income comes from the sale of livestock and livestock products. The principal livestock on farms in 1969 were 41,007 cattle and calves, of which 6,465 were milk cows; 77,206 hogs and pigs; 10,468 sheep and lambs, and 36,028 chickens, 3 months old or older.

More than one-fourth of the farm income comes from the sale of crops. The acreage of principal crops harvested in 1969 was 46,071 of corn, 26,558 of soybeans, 18,543 of wheat, 22,865 of hay, and 471 of tobacco.

Geology

Although several factors have contributed to the formation of more than 75 different kinds of soil, the glaciation of nearly all of the county is one of the most significant. Two major glaciations covered a large part of the county. Only the southeastern part of Brush Creek and Jackson Townships have not been glaciated. The oldest glacial deposits in the county are of Illinoian age. Younger glacial deposits are associated with the early and late stages of the Wisconsin glaciation. The southernmost extent of the two Wisconsin stages are represented by the Cuba (early) and Reesville (late) end moraines. The Cuba end moraine has inner and outer segments and is north of the area glaciated in Illinoian time. This moraine extends from near New Vienna east through Samantha to north of Boston and Rainsboro and then to Rattlesnake Creek and the Ross County line. The Reesville end moraine is the most northerly and extends from the northwest part north of Leesburg and east through East Monroe and Greenfield to the Ross County line.

On the glacial till plains of Wisconsin age, the thickness of till is highly variable but generally ranges from 10 to 25 feet. On the end moraines, the depth of till to bedrock is as much as 40 to 65 feet or more.

The glaciated area of Illinoian age is the most extensive in Highland County and consists of two highly contrasting topographic regions. One is the nearly level area in the western part of the county commonly called the "Crayfish Flats." The other is the gently sloping to moderately steep, dissected area in the north-central and southern parts of Highland County. Also present in this glaciated area are the nearly level to moderately steep areas of kames, moraines, and outwash. The glaciated areas mainly extend from south and southwest of Hillsboro and near Rocky Fork Lake and Rainsboro east to the Ross County line.

Most of the unglaciated areas in southeastern Brush Creek and Jackson Townships are in the Central Lowlands physiographic province. The rest of the unglaciated area in central and northern Brush Creek Township adjacent to the Pike County line is in the hilly, dissected Allegheny Plateau.

The glacial till in the nearly level Illinoian till plains is generally 10 to 30 feet thick, but in the hilly Illinoian till plains it is only a few inches to normally less than 10 feet thick. In the unglaciated part of the county, the soils are relatively shallow to bedrock. The depth to bedrock ranges from outcrops on the surface to generally only 5 feet. Many streams in the central, southern, and southeastern parts of Highland County have cut into and are flowing on bedrock of limestone or shale.

Nearly all of the county has been covered to varying thickness with loess or windblown material. The loess consists predominantly of silt-sized particles. It ranges from 1 to 4 feet in thickness. The thinnest deposits of loess are 0 to 18 inches thick and are on the Reesville end moraine in the northeastern part of the county. The thickest of these deposits are 18 to 40 inches thick and are on the nearly level glacial till plains of Illinoian age or "Crayfish Flats" area in the western part of the county.

The western parts of the county are underlain by bedrock of limestone and shale of Ordovician age. The hilly, unglaciated Allegheny Plateau area south of U.S. Route 50 in the extreme eastern part of the county is underlain by Devonian shale that is capped by Mississippian sandstone bedrock.

Geologic resources include deposits of sand and gravel suitable for construction purposes. Limestone bedrock is crushed and used in construction for agricultural limestone and cement; shale bedrock and heavy clay glacial till is used to produce agricultural drainage tile. One limestone formation in the county contains asphalt material that, when crushed, is particularly suited to highway construction and maintenance material.

Relief and Drainage

Highland County has a wide range in elevation that ranges from 720 feet along Middle Fork of Ohio Brush Creek at the Adams County line to 1,343 feet on Washburn Hill. This hill is in the Allegheny Plateau area west of the Pike County line. The county is drained by several large streams in each of four major watersheds. The northwestern part is in the watershed of the Miami River and is drained by the East Fork of the Little Miami River and its tributaries; the western and south-central and eastern parts are in the watershed of the Scioto River and are drained by Rocky Fork, Clear, Rattlesnake, and Paint Creeks and their tributaries. All of these are a part of the Ohio River drainage system.

Water Supply

Most homes and farms in the rural areas depend on wells for their water supply. These wells derive their water from the glacial materials that overlie the bedrock. In areas of thick glacial material, particularly sand and gravel deposits, water can generally be obtained for domestic use. Most farms in southern and southeastern Highland County, where glacial material, if any, occurs in thin layers, use cisterns and ponds to supplement the water supplied by the well. The water obtained from the wells is usually low in quantity and frequently of poor quality. The construction of farm ponds in the central, southern, and southeast parts of the county is limited because the soil material is thin and shallow to bedrock.

Recently, water resources in the county have been further developed by a cooperative rural water facility. This facility provides supply treatment and distribution services to many rural areas in the county.

Climate [6]

The climate of Highland County is marked by large annual, daily, and day to day ranges of temperature. The summers are moderately warm and humid and have several days when the temperature is in the nineties. Winters are reasonably cold and cloudy, but days when the temperature is below zero are rare.

[6] By JERRY M. DAVIS, climatologist for Ohio, National Weather Service, U.S. Department of Commerce.

TABLE 10.—*Laboratory*

Soil and sample number	Horizon	Depth	Particle size distribution								
			Very coarse sand (2–1 mm)	Coarse sand (1–0.5 mm)	Medium sand (0.5–0.25 mm)	Fine sand (0.25–0.10 mm)	Very fine sand (0.10–0.05 mm)	Total sand (2.0–0.05 mm)	Silt (0.05–0.002 mm)	Clay (<0.002 mm)	Fine clay (<0.0002 mm)
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Atlas silt loam (HY–48).	Ap	0–7	0.5	2.2	3.2	9.1	7.5	22.5	55.0	22.5	9.2
	B1t	7–12	.4	1.6	2.5	8.6	8.1	21.2	44.9	33.9	18.9
	IIB21t	12–17	.5	2.1	3.3	9.9	8.8	24.6	36.8	38.6	24.7
	IIB22t	17–24	.6	2.1	2.9	8.3	7.9	21.8	39.3	38.9	24.3
	IIB23tg	24–30	.4	1.5	2.0	5.7	5.9	15.5	41.7	42.8	25.3
	IIB24t	30–37	.3	1.1	1.5	4.5	5.0	12.4	41.1	46.5	24.1
	IIB24t	37–44	.3	.9	1.3	4.1	4.7	11.3	43.2	45.5	20.4
	IIB31	44–51	.3	1.2	1.8	5.1	5.9	14.3	45.2	40.5	17.1
	IIB32	51–67	1.7	5.2	4.1	9.0	8.0	28.0	41.2	30.8	13.5
	IIC1	67–77	1.6	4.1	3.8	10.0	8.9	28.4	42.8	28.8	11.4
	IIC2	77–90	3.0	5.6	4.5	10.7	9.2	33.0	43.7	23.3	6.8
Avonburg silt loam (HY–50).	Ap	0–9	1.4	3.3	3.2	8.2	7.2	23.3	63.8	12.9	3.5
	A2	9–15	.8	2.2	2.7	7.4	6.5	19.6	62.7	17.7	6.1
	B1	15–22	.6	2.0	2.3	6.2	5.6	16.7	62.0	21.3	8.1
	B21t	22–31	.5	1.6	2.0	4.8	6.1	15.0	60.1	24.9	10.6
	IIBx	31–39	.5	1.5	1.8	5.0	4.7	13.5	57.3	29.2	14.9
	IIB22t	39–47	.4	1.6	2.2	6.2	5.6	16.0	49.0	35.0	21.8
	IIB23t	47–55	.4	2.0	2.7	8.0	7.1	20.2	44.8	35.0	20.0
	IIB31	55–66	.5	2.0	2.9	8.2	8.4	22.0	42.9	35.1	20.8
	IIB32	66–86	.7	2.4	3.1	8.7	8.4	23.3	39.3	37.4	20.9
	IIC1	86–99	.4	2.0	3.0	8.9	8.4	22.7	40.0	37.3	18.1
	IIC2	99–124	3.8	6.3	4.9	10.4	9.1	34.5	43.2	22.3	7.3
Blanchester silt loam (HY–44).	Ap	0–4	1.0	1.7	2.3	6.8	6.3	18.1	60.1	21.8	7.2
	Ap	4–9	.7	1.6	2.1	6.7	6.3	17.4	61.3	21.3	7.7
	B1tg	9–15	.9	1.4	1.8	5.9	5.2	15.2	55.6	29.2	14.8
	B21tg	15–21	.7	1.5	1.8	5.6	5.1	14.7	52.6	32.7	17.8
	B22tg	21–28	.8	1.5	1.7	5.5	4.8	14.3	51.5	34.2	19.5
	B22tg	28–35	.5	1.2	1.4	4.6	4.4	12.1	52.9	35.0	20.4
	IIB23tg	35–44	.4	.9	1.1	3.5	3.5	9.4	53.3	37.3	23.0
	IIB3tg	44–51	.4	.9	1.1	3.5	3.7	9.6	56.6	33.8	20.8
	IIC1	51–70	1.3	3.1	3.1	7.8	6.7	22.0	42.4	35.6	13.3
	IIC2	70–84	.4	1.6	2.1	6.1	5.6	15.8	47.6	36.6	18.5
Boston silt loam (HY–60).	Ap	0–8	.2	.8	.7	1.2	1.1	4.0	78.8	17.2	4.2
	AtB	8–12	.1	.4	.3	.6	.7	2.1	71.8	26.1	11.6
	B2t	12–18	.2	.5	.4	.8	.9	2.8	69.0	28.2	15.3
	IIBx1	18–23	1.1	1.8	1.4	3.7	2.6	10.6	59.4	30.0	17.8
	IIBx2	23–32	3.8	2.8	2.3	5.5	3.8	18.2	47.4	34.4	19.8
	IIIB31	32–42	.3	.4	.5	1.3	1.2	3.7	22.6	73.7	37.8
	IIIB32	42–53	2.0	1.6	.9	2.0	1.4	7.9	21.1	70.9	32.0
	IIIC	53–58	3.0	6.1	2.9	36.0	16.8	64.8	10.9	24.3	18.2
Cincinnati silt loam (HY–63).	Ap	0–10	.5	1.6	1.5	3.1	2.4	9.1	74.9	16.0	3.6
	B1	10–16	.3	.9	1.1	2.4	1.9	6.6	68.1	25.3	8.8
	B21t	16–22	.5	1.2	1.3	3.0	2.3	8.3	62.1	29.6	15.2
	B21t	22–28	1.2	2.0	2.3	5.9	4.5	15.9	56.9	27.2	14.8
	IIB22t	28–35	2.3	3.1	3.5	9.4	6.9	25.2	48.8	26.0	13.7
	IIBx1	35–45	2.9	3.2	3.6	9.5	7.2	26.4	45.7	27.9	15.7
	IIBx2	45–52	1.6	3.0	3.6	9.9	7.5	25.6	43.7	30.7	16.6
	IIB31t	52–58	2.3	3.1	3.4	8.9	6.9	24.6	39.8	35.6	20.0
	IIB32	58–70	1.8	3.9	4.3	10.8	7.9	28.7	35.9	35.4	19.6
	IIB32	70–90	2.5	4.5	5.1	12.5	8.7	33.3	37.0	29.7	15.4
	IIC	90–115	7.4	8.4	6.4	13.7	10.0	45.9	36.7	17.4	5.6

See footnote at end of table.

data

Texture	Reaction	Organic-matter content	Calcium carbonate equivalent	Extractable cations				Sum of extractable cations	Sum of bases	Base saturation (sum)
				H	Ca	Mg	K			
	pH	*Percent*	*Percent*	*Meq per 100 grams of soil*	*Meq per 100 grams of soil*	*Meq per 100 grams of soil*	*Meq per 100 grams of soil*	*Meq per 100 grams of soil*	*Meq per 100 grams of soil*	*Percent*
Silt loam	5.2	1.4		8.8	6.1	1.5	0.20	16.6	7.8	47
Clay loam	4.6	1.4		16.4	3.4	2.6	.26	22.7	6.3	28
Clay loam	4.5	.2		18.0	3.5	4.0	.28	25.8	7.8	30
Clay loam	4.5	.3		17.1	4.0	5.3	.28	26.8	9.6	36
Silty clay	4.6	.2		17.4	5.1	6.9	.32	29.7	12.3	41
Silty clay	4.6	.3		17.0	6.5	7.6	.31	31.4	14.4	46
Silty clay	4.6	.2		13.1	7.0	8.4	.28	28.8	15.7	54
Silty clay	5.2	.2		4.4	8.8	9.7	.26	23.2	18.8	81
Clay loam	6.6			4.2	9.3	8.3	.22	22.0	17.8	81
Clay loam	7.5		5.7							
Loam	7.9		17.2							
Silt loam	6.1	2.7		5.4	5.2	1.4	.33	12.3	6.9	56
Silt loam	4.8	.7		7.7	1.9	.7	.15	10.4	2.7	26
Silt loam	4.6	.3		11.1	.9	.6	.13	12.7	1.6	13
Silt loam	4.5	.3		13.5	.8	1.2	.18	15.7	2.2	14
Silty clay loam	4.5	.3		15.7	1.5	2.2	.20	19.6	3.9	20
Silty clay loam	4.5	.3		18.9	2.5	3.3	.22	24.9	6.0	24
Clay loam	4.4	.2		14.4	4.5	5.5	.24	24.6	10.2	42
Clay loam	4.6	.2		12.0	6.6	7.2	.23	26.0	14.0	54
Clay loam	5.8	.2		6.1	12.0	10.5	.22	28.8	22.7	79
Clay loam	6.8	.2		3.7	19.3	10.1	.21	33.3	29.6	89
Loam	7.9									
Silt loam	6.5	2.9		4.6	10.1	4.3	.20	19.2	14.6	76
Silt loam	6.3	2.9		4.9	10.0	3.9	.20	19.0	14.1	74
Silty clay loam	5.6	1.9		7.4	11.6	5.5	.20	24.7	17.3	70
Silty clay loam	5.6	.9		5.9	11.3	6.0	.20	23.4	17.5	75
Silty clay loam	5.8			5.9	12.0	6.9	.30	25.1	19.2	76
Silty clay loam	6.1			4.4	13.1	7.4	.26	25.2	20.8	83
Silty clay loam	6.4			3.9	14.7	8.7	.40	27.7	23.8	86
Silty clay loam	6.7			2.9	14.0	6.6	.40	23.9	21.0	88
Clay loam	7.4		.3							
Silty clay loam	7.3		.4							
Silt loam	7.0	1.8		3.3	6.8	1.5	.20	11.8	8.5	72
Silt loam	6.0	.7		6.1	5.9	2.0	.21	14.2	8.1	57
Silty clay loam	5.1	.5		8.6	5.0	3.3	.22	17.1	8.5	50
Silty clay loam	5.3	.3		7.2	5.6	5.1	.26	18.2	11.0	60
Silty clay loam	6.1	.3		5.1	7.6	8.0	.25	21.0	15.9	76
Clay	6.9			6.3	18.1	13.6	.31	38.3	32.0	84
Clay	7.4		2.3							
Sandy clay loam	7.8		72.1							
Silt loam	5.3	2.0		[1] ND	1.8	.6	.27	ND	2.7	ND
Silt loam	5.4	.8		6.7	3.8	1.2	.20	11.9	5.2	44
Silty clay loam	5.5	.7		7.0	5.0	2.0	.27	14.3	7.3	51
Silty clay loam	5.5	.5		6.8	6.2	3.7	.22	16.9	10.1	60
Loam	5.3	.3		6.7	4.5	2.6	.19	14.0	7.3	52
Clay loam	5.3	.3		7.7	5.1	3.3	.20	16.3	8.6	53
Clay loam	5.4	.3		6.5	7.1	2.8	.20	16.6	10.1	61
Clay loam	5.4	.3		5.9	12.0	6.5	.23	24.6	18.7	76
Clay loam	6.2	.3		4.2	11.9	4.0	.17	20.3	16.1	79
Clay loam	6.2	.3		3.2	11.4	4.8	.21	19.6	16.4	84
Loam	7.8	.3	33.1							

TABLE 10.—*Laboratory*

Soil and sample number	Horizon	Depth	Particle size distribution								
			Very coarse sand (2–1 mm)	Coarse sand (1–0.5 mm)	Medium sand (0.5–0.25 mm)	Fine sand (0.25–0.10 mm)	Very fine sand (0.10–0.05 mm)	Total sand (2.0–0.05 mm)	Silt (0.05–0.002 mm)	Clay (<0.002 mm)	Fine clay (<0.0002 mm)
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Clermont silt loam (HY–49).	Ap	0–7	.8	2.6	2.2	4.7	4.1	14.4	67.6	18.0	4.8
	A2	7–13	.8	2.0	1.9	3.9	4.0	12.6	65.0	22.4	7.7
	A&B	13–17	.6	1.7	1.5	3.5	3.3	10.6	60.9	28.5	12.8
	B&A	17–25	.4	1.2	1.3	3.0	3.2	9.1	58.6	32.3	16.2
	B21tg	25–37	.5	1.4	1.5	3.5	3.2	10.1	56.7	33.2	19.2
	IIB22tg	37–43	.7	2.7	2.3	4.6	3.9	14.2	45.9	39.9	22.6
	IIB23tg	43–50	.5	1.9	2.3	5.3	4.5	14.5	41.0	44.5	28.0
	IIB24t	50–62	.6	1.7	2.3	6.0	5.4	16.0	39.1	44.9	35.6
	IIB31	62–78	.8	2.4	2.6	6.5	6.5	18.8	38.7	42.5	22.9
	IIB32	78–94	.7	2.7	3.3	9.0	7.9	23.6	42.4	34.0	16.7
	IIC1	94–100	3.7	5.0	4.1	8.1	7.6	28.5	37.4	34.1	17.7
	IIC2	100–116	4.9	7.4	6.3	12.9	11.6	43.1	40.6	16.3	6.1
Fitchville silt loam (HY–61).	Ap	0–10	1.3	1.9	1.3	2.2	3.2	9.9	74.3	15.8	3.4
	A2	10–15	1.3	2.2	1.4	2.1	3.2	10.2	69.1	20.7	7.4
	B1t	15–22	.7	1.2	.8	1.6	3.3	7.6	65.6	26.8	12.4
	B21t	22–29	.4	.7	.5	1.4	2.7	5.7	66.4	27.9	13.7
	B22t	29–37	1.7	3.6	2.2	3.3	3.4	14.2	58.9	26.9	12.2
	B23t	37–47	2.1	5.2	2.8	4.1	4.1	18.3	52.2	29.5	17.3
	IIB31t	47–57	2.0	4.8	3.8	7.2	5.7	23.5	47.0	29.5	18.2
	IIB32	57–68	10.7	16.1	8.3	6.2	3.8	45.1	26.8	28.1	18.0
	IIB33	68–77	5.2	15.1	9.0	8.1	5.0	42.4	28.1	29.5	20.5
	IIC1	77–90	3.5	11.5	5.0	8.5	10.4	38.9	45.8	15.3	10.3
	IIC2	90–106									
Haubstadt silt loam (HY–53).	Ap	0–6	.7	2.8	3.6	7.0	4.0	18.1	66.7	15.2	3.6
	B1	6–10	.8	2.3	3.2	6.1	3.4	15.8	65.2	19.0	5.9
	B2t	10–18	2.7	4.6	6.1	12.4	6.9	32.7	47.2	20.1	8.0
	IIBx1	18–28	2.5	5.3	7.8	17.5	10.6	43.7	39.9	16.4	7.4
	IIBx2	28–37	2.1	4.7	6.8	15.5	9.9	39.0	39.8	21.2	9.4
	IIBx3	37–45	2.2	5.2	7.0	15.1	9.5	39.0	37.5	23.5	11.6
	IIBx3	45–53	2.6	5.0	6.8	15.1	9.5	39.0	35.4	25.6	12.8
	IIB31t	53–59	2.0	4.8	6.7	14.1	9.2	37.1	35.7	27.2	14.2
	IIB32t	59–73	5.6	6.3	6.0	12.4	8.0	38.3	31.6	30.1	16.5
	IIC1	73–110	3.5	6.2	5.7	11.5	7.8	34.7	35.8	29.5	13.6
Loudon silt loam (HY–62).	Ap	0–8	1.3	2.9	2.4	5.4	3.5	15.5	67.9	16.6	3.5
	B1	8–12	2.0	2.9	2.1	4.2	2.9	14.1	62.7	23.2	6.8
	B21t	12–19	1.2	1.8	1.3	2.9	2.1	9.3	61.4	29.3	11.5
	IIB22t	19–26	.8	1.1	.8	2.2	1.7	6.6	56.7	36.7	18.9
	IIB23t	26–38	.5	1.3	1.6	4.3	2.9	10.6	43.6	45.8	29.4
	IIIB31	38–45	.1	.3	.2	.7	1.3	2.6	43.7	53.7	21.6
	IIIB32	45–58	.8	.4	.2	.2	1.2	2.8	55.0	42.2	13.2
	IIIC1	58–70	.2	.2	.1	.2	.8	1.5	62.0	36.5	9.1
	IIIC2	70–81	.5	.3	.1	.3	1.7	2.9	66.6	30.5	6.7
	IIIR	81–100	.9	.6	.3	.6	2.2	4.6	67.6	27.8	5.6
Negley loam (HY–64).	Ap	0–5	5.1	11.0	7.6	7.9	3.9	35.5	45.5	19.0	7.9
	Ap	5–8	7.2	9.7	6.3	6.9	3.9	34.0	47.3	18.7	7.8
	B1	8–14	10.7	13.4	8.6	9.3	5.1	47.1	36.6	16.3	7.2
	B21t	14–24	9.8	14.8	9.7	9.8	5.2	49.3	32.1	18.6	7.0
	B22t	24–33	10.0	15.9	7.5	7.1	4.1	44.6	23.1	32.3	13.9
	B23t	33–42	11.9	23.6	7.9	4.7	2.4	50.5	16.6	32.9	12.2
	B24t	42–57	10.3	25.7	9.3	5.2	2.4	52.9	13.4	33.7	13.3
	B25t	57–72	10.3	20.7	8.3	5.2	2.3	47.8	16.5	35.7	17.7
	B31t	72–92	6.0	26.5	16.3	8.5	2.6	59.9	12.1	28.0	13.8
	B32	92–108	13.5	30.0	16.8	9.9	1.9	72.1	10.7	17.2	8.1
	B33	108–126	12.0	35.9	16.0	9.1	1.5	74.5	10.8	14.7	7.1
	C	126–156	12.0	43.5	19.6	7.6	1.5	84.2	10.9	4.9	2.0

See footnote at end of table.

data—Continued

Texture	Reaction	Organic-matter content	Calcium carbonate equivalent	Extractable cations				Sum of extractable cations	Sum of bases	Base saturation (sum)
				H	Ca	Mg	K			
	pH	*Percent*	*Percent*	*Meq per 100 grams of soil*	*Meq per 100 grams of soil*	*Meq per 100 grams of soil*	*Meq per 100 grams of soil*	*Meq per 100 grams of soil*	*Meq per 100 grams of soil*	*Percent*
Silt loam	6.2	1.7		3.6	6.2	2.1	.18	12.1	8.5	70
Silt loam	5.1	.7		6.4	3.7	2.1	.18	12.4	6.0	48
Silty clay loam	4.8	.3		9.5	2.9	1.9	.20	14.5	5.0	34
Silty clay loam	4.8	.3		10.5	3.3	3.6	.26	17.7	7.2	41
Silty clay loam	4.8	.3		12.3	3.9	4.4	.29	20.9	8.6	41
Silty clay loam	4.7	.5		16.6	6.4	6.6	.36	30.0	13.4	45
Silty clay	4.8	.5		15.8	7.7	8.6	.38	32.5	16.7	51
Clay	4.9	.5		16.8	8.4	8.9	.31	34.4	17.6	51
Clay	6.0	.3		8.0	13.3	12.3	.31	33.9	25.9	76
Clay loam	7.0	.1		2.1	10.5	8.6	.26	21.5	19.4	90
Clay loam	7.1	.3		4.7	12.3	8.9	.26	26.2	21.5	82
Loam	7.7		27.8							
Silt loam	7.0	2.0		4.1	6.5	2.3	.17	13.1	9.0	69
Silt loam	6.8	.7		4.1	5.1	1.8	.12	11.1	7.0	63
Silt loam	5.4	.5		8.6	5.1	2.6	.20	16.5	7.9	48
Silty clay loam	5.1	.5		11.9	3.7	2.2	.25	18.0	6.1	34
Silt loam	5.2	.3		10.2	5.0	3.9	.20	19.3	9.1	47
Silty clay loam	5.7	.3		6.5	7.0	6.0	.29	19.8	13.3	67
Clay loam	6.4	.3		4.5	10.3	8.7	.31	23.8	19.3	81
Sandy clay loam	6.8			5.3	7.9	3.1	.26	16.6	11.3	68
Clay loam	7.1			4.0	12.0	7.7	.36	24.1	20.1	83
Loam	7.7		55.5							
	7.8		26.7							
Silt loam	5.0	1.7		7.1	2.1	.5	.31	10.0	2.9	29
Silt loam	5.1	.5		6.3	2.6	.6	.08	9.6	3.3	34
Loam	4.8	.3		8.8	2.2	.8	.10	11.9	3.1	26
Loam	4.7	.2		6.5	1.1	.9	.23	8.7	2.2	26
Loam	4.8	.2		5.7	1.8	1.8	.26	9.6	3.9	40
Loam	4.8	.2		8.7	3.7	3.4	.31	16.1	7.4	46
Loam	4.8	.2		8.5	2.8	2.3	.28	13.9	5.4	39
Clay loam	4.9	.2		7.2	4.8	4.5	.19	16.7	9.5	57
Clay loam	5.5	.2		5.9	4.9	3.7	.31	14.8	8.9	60
Clay loam	6.8	.3		2.5	7.6	5.5	.31	15.9	13.4	84
Silt loam	5.8	2.9		9.1	3.1	1.0	.40	13.6	4.5	33
Silt loam	5.3	1.0		9.1	2.2	1.4	.43	13.1	4.0	31
Silty clay loam	5.0	.7		12.2	2.0	1.8	.37	16.4	4.2	25
Silty clay loam	4.9	.5		14.4	3.2	5.0	.33	22.9	8.5	38
Silty clay	5.3	.5		11.9	5.3	9.5	.44	27.1	15.2	56
Silty clay	7.8		14.0							
Silty clay	8.0		30.4							
Silty clay loam	8.0		22.4							
Silty clay loam	8.1		29.8							
Silty clay loam	8.0		29.5							
Loam	6.9	1.4		3.6	5.0	1.7	.27	10.6	7.0	66
Loam	6.6	1.0		3.7	3.9	1.5	.17	9.3	5.6	60
Loam	5.4	.3		4.4	2.2	1.3	.12	8.0	3.6	45
Loam	5.2	.3		5.9	2.0	1.3	.18	9.4	3.5	37
Clay loam	5.4	.3		7.8	3.6	2.1	.26	13.8	6.0	43
Sandy clay loam	5.4	.3		8.0	3.1	2.8	.27	14.2	6.2	44
Sandy clay loam	5.2	.3		8.7	2.8	2.7	.22	14.4	5.7	40
Sandy clay	5.2	.3		10.5	3.7	2.9	.25	17.3	6.8	39
Sandy clay loam	5.3	.3		7.9	3.1	2.6	.23	13.8	5.9	43
Coarse sandy loam	5.7	.3		4.6	3.2	2.4	.16	10.4	5.8	56
Coarse sandy loam	6.4	.3		3.3	5.6	2.8	.15	11.8	8.5	72
Loamy coarse sand	7.7	.5	40.6							

TABLE 10.—*Laboratory*

Soil and sample number	Horizon	Depth	Particle size distribution								
			Very coarse sand (2–1 mm)	Coarse sand (1–0.5 mm)	Medium sand (0.5–0.25 mm)	Fine sand (0.25–0.10 mm)	Very fine sand (0.10–0.05 mm)	Total sand (2.0–0.05 mm)	Silt (0.05–0.002 mm)	Clay (<0.002 mm)	Fine clay (<0.0002 mm)
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Nicholson silt loam (HY–59).	Ap	0–8	.7	1.6	.9	1.3	1.2	5.7	77.7	16.6	3.4
	B1	8–14	1.2	1.5	.6	.6	.9	4.8	69.8	25.4	10.0
	B2t	14–24	1.7	2.0	.7	.7	.9	6.0	67.3	26.7	13.3
	Bx1	24–34	5.3	3.6	1.2	1.2	1.4	12.7	66.3	21.0	8.7
	IIBx2	34–42	4.4	2.8	1.0	1.2	1.4	10.8	54.2	35.0	14.7
	IIB31	42–50	1.0	1.4	.7	1.1	1.2	5.4	37.9	56.7	30.5
	IIB32	50–67	1.6	1.9	1.0	1.4	1.7	7.6	34.7	57.7	31.5
	IIB33	67–74	.4	.7	.5	1.3	4.7	7.6	46.3	46.1	23.1
Ockley silt loam (HY–66).	Ap	0–6	.7	1.7	1.8	6.4	9.0	19.6	67.1	13.3	3.3
	B&A	6–9	.3	1.1	1.3	5.1	7.7	15.6	65.3	19.1	7.3
	B1t	9–14	.2	.7	1.1	4.7	7.4	14.1	57.7	28.2	14.3
	B21t	14–21	.4	.8	1.3	6.2	7.9	16.6	52.8	30.6	17.3
	IIB22t	21–27	.8	1.5	2.3	10.8	9.8	25.2	48.2	26.6	13.7
	IIB23t	27–33	3.1	4.9	5.3	21.0	10.2	44.5	33.8	21.7	10.7
	IIB24t	33–42	19.7	12.5	4.8	9.0	3.7	49.6	26.7	23.7	11.4
	IIB32	42–52	.3	.3	.2	.6	6.9	8.3	63.1	28.6	10.7
	IIB33	52–58	.3	.4	.2	.7	9.4	11.1	62.4	26.5	10.8
	IIC	58–70	39.6	31.4	4.4	1.5	.8	77.7	6.2	16.1	9.0
Opequon silt loam (HY–54).	Ap	0–5	.1	.6	.5	1.0	1.0	3.2	73.6	23.2	8.1
	IIB21t	5–8	.2	.2	.2	.5	.8	1.9	58.7	39.8	23.2
	IIB22t	8–15	.3	.4	.3	1.0	.8	2.8	32.4	64.8	43.4
	IIC	15–19	1.9	3.6	4.5	32.7	18.8	61.5	19.6	18.9	12.1
Rossmoyne silt loam (HY–51).	Ap	0–8	.8	2.6	2.1	4.1	3.0	12.6	70.6	16.8	3.8
	A2	8–12	.5	1.6	1.5	2.7	3.1	9.4	67.4	23.2	8.1
	B1	12–17	.2	1.3	1.5	3.2	3.1	9.3	64.3	26.4	11.9
	B2t	17–23	.5	1.7	2.3	5.3	4.5	14.3	54.0	31.7	18.1
	IIBx1	23–30	1.0	2.5	3.1	7.7	6.8	21.1	47.3	31.6	18.0
	IIBx1	30–37	1.1	2.9	3.9	9.8	7.8	25.5	45.9	28.6	14.7
	IIBx2	37–45	1.2	3.0	4.1	10.4	8.3	27.0	48.1	24.9	12.8
	IIBx2	45–56	1.4	3.4	4.6	11.9	8.9	30.2	46.4	23.4	11.2
	IIB3t	56–70	.7	2.5	3.7	9.0	7.1	23.0	37.9	39.1	20.7
	IIB3t	70–81	.9	3.3	4.3	10.7	8.5	27.7	39.8	32.5	14.6
	IIC	81–97	2.9	4.9	4.6	10.8	8.9	32.1	43.7	24.2	8.9
Russell silt loam (HY–58).	Ap	0–8	.7	1.7	1.4	2.8	2.2	8.8	79.2	12.0	2.0
	A2	8–11	.1	1.2	1.3	2.4	1.9	6.9	77.6	15.5	3.5
	B1t	11–17	.3	.9	1.0	1.8	1.6	5.6	71.7	22.7	8.5
	B21t	17–26	.8	1.0	.9	2.0	1.9	6.6	64.3	29.1	14.9
	IIB22t	26–44	1.3	2.3	2.0	5.2	7.8	18.6	58.2	23.2	12.2
	IIB3	44–61	2.7	4.8	4.7	10.2	7.6	30.0	44.2	25.8	11.0
	IIC1	61–75	2.9	5.3	5.7	13.0	10.0	36.9	47.3	15.8	4.9
	IIC2	75–82	2.6	4.4	4.5	11.1	8.9	31.5	50.0	18.5	6.4
Sardinia silt loam (HY–55).	Ap	0–9	.1	.6	.7	3.6	6.5	11.5	72.1	16.4	3.7
	B1t	9–16	.0	.1	.2	1.2	3.5	5.0	65.3	29.7	14.2
	IIB21t	16–22	.0	.2	.3	2.2	5.0	7.7	63.7	28.6	15.0
	IIB22t	22–32	.0	.4	1.2	7.5	7.8	16.9	57.8	25.3	14.0
	IIB23t	32–42	.0	.4	1.1	8.6	10.0	20.1	54.4	25.5	15.1
	IIB24	42–55	.1	.4	.7	5.2	10.8	17.2	59.0	23.8	14.1
	IIB31	55–62	.9	3.7	5.1	14.7	11.1	35.5	44.3	20.2	12.7
	IIB32	62–71	1.1	4.7	6.1	14.2	9.5	35.6	44.1	20.3	11.7
	IIIC	71–85	14.7	21.1	7.6	6.4	5.6	55.4	24.0	20.6	13.2

See footnote at end of table.

data—Continued

Texture	Reaction	Organic-matter content	Calcium carbonate equivalent	Extractable cations				Sum of extractable cations	Sum of bases	Base saturation (sum)
				H	Ca	Mg	K			
	pH	*Percent*	*Percent*	*Meq per 100 grams of soil*	*Meq per 100 grams of soil*	*Meq per 100 grams of soil*	*Meq per 100 grams of soil*	*Meq per 100 grams of soil*	*Meq per 100 grams of soil*	*Percent*
Silt loam	5.5	2.0		8.0	3.7	.8	.15	12.6	4.6	37
Silt loam	5.8	.7		7.7	6.4	2.0	.18	16.3	8.6	53
Silt loam	5.3	.3		9.3	4.7	2.6	.19	16.8	7.5	45
Silt loam	5.3	.3		7.9	3.6	2.3	.14	13.9	6.0	43
Silty clay loam	6.3	.3		4.4	7.9	5.1	.20	17.6	13.2	75
Clay	6.9	.7		4.0	16.9	4.8	.20	25.9	21.9	85
Clay	7.2	1.0		5.1	13.9	7.8	.23	27.0	21.9	81
Silty clay	7.5		.7							
Silt loam	5.9	1.5		6.4	3.9	1.1	.54	11.9	5.5	46
Silt loam	5.6	1.0		6.8	4.5	1.7	.39	13.4	6.6	49
Silty clay loam	5.5	.5		7.4	6.3	2.7	.33	16.7	9.3	56
Silty clay loam	5.2	.5		8.8	6.6	2.9	.31	18.6	9.8	53
Loam	5.2	.5		9.6	5.5	2.7	.30	18.1	8.5	47
Loam	5.5	.5		6.8	5.0	2.7	.23	14.7	7.9	54
Loam	5.3	.7		7.2	4.5	2.8	.31	14.8	7.6	51
Silty clay loam	7.4		19.4							
Silt loam	7.7		13.1							
Coarse sandy loam	7.4		.3							
Silt loam	6.8	2.4		4.2	8.5	4.0	.43	17.1	12.9	75
Silty clay loam	6.8	1.2		6.5	10.9	6.7	.56	24.7	18.2	74
Clay	6.6	2.2		9.7	18.7	14.6	.77	43.8	34.1	78
Fine sandy loam	7.6		81.0							
Silt loam	5.8	1.7		7.6	4.4	.5	.22	12.7	5.1	40
Silt loam	5.0	.7		10.5	3.1	.8	.20	14.6	4.1	28
Silt loam	4.7	.5		10.8	2.9	1.5	.26	15.5	4.7	30
Silty clay loam	4.7	.5		14.1	4.8	3.1	.31	22.3	8.2	37
Clay loam	4.7	.1		11.6	5.1	3.5	.29	20.5	8.9	43
Clay loam	4.8	.1		9.0	4.9	4.6	.20	18.7	9.7	52
Loam	5.8	.1		4.5	7.4	5.8	.18	17.9	13.4	75
Loam	6.5	.1		3.3	7.1	4.9	.15	15.4	12.1	79
Clay loam	7.0	.1		4.3	14.4	9.2	.20	28.1	23.8	85
Clay loam	7.3		1.1							
Loam	7.9		20.6							
Silt loam	7.3	2.4		ND	5.2	1.5	.48		7.2	ND
Silt loam	7.0	1.2		3.7	4.6	1.4	.29	10.0	6.3	63
Silt loam	6.3	.5		5.6	4.5	1.6	.24	11.9	6.3	53
Silty clay loam	5.2	.7		9.6	5.0	1.8	.27	16.7	7.1	42
Silt loam	5.6	.3		7.9	6.8	2.4	.21	17.3	9.4	54
Loam	6.2	.5		4.7	6.5	2.8	.22	14.2	9.5	67
Loam	7.9		12.7							
Loam	7.7		8.2							
Silt loam	6.1	2.2		5.3	6.4	2.2	.14	14.0	8.7	62
Silty clay loam	6.5	.7		5.1	9.7	4.1	.21	19.1	14.0	72
Silty clay loam	6.1	.7		6.0	7.9	3.5	.24	17.6	11.6	66
Silt loam	5.1	.3		10.5	6.0	3.9	.19	20.6	10.1	49
Silt loam	5.3	.5		7.4	8.0	5.4	.23	21.0	13.6	65
Silt loam	6.3	.3		3.5	8.9	5.9	.18	18.5	15.0	81
Loam	6.6	.3		2.3	7.8	5.8	.18	15.1	12.8	85
Loam	6.6	.1		2.6	8.2	5.0	.18	16.0	13.4	84
Sandy clay loam	7.1			2.6	10.2	4.4	.19	17.4	14.8	85

TABLE 10.—*Laboratory*

Soil and sample number	Horizon	Depth	Particle size distribution								
			Very coarse sand (2–1 mm)	Coarse sand (1–0.5 mm)	Medium sand (0.5–0.25 mm)	Fine sand (0.25–0.10 mm)	Very fine sand (0.10–0.05 mm)	Total sand (2.0–0.05 mm)	Silt (0.05–0.002 mm)	Clay (<0.002 mm)	Fine clay (<0.0002 mm)
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Williamsburg silt loam (HY-65).	Ap	0–9	.7	2.0	2.3	3.5	1.9	10.4	73.2	16.4	3.4
	A2	9–12	.9	1.4	1.5	2.5	1.4	7.7	69.4	22.9	9.0
	B1	12–17	.4	1.1	1.3	2.5	1.4	6.7	66.8	26.5	13.5
	B21t	17–23	.6	1.5	2.0	4.0	2.2	10.3	60.2	29.5	16.4
	IIB22t	23–30	1.5	4.2	5.1	9.9	4.7	25.4	48.7	25.9	15.0
	IIB23t	30–37	5.1	9.3	10.0	20.3	5.9	50.6	22.2	27.2	17.5
	IIB31	37–42	11.7	15.6	8.3	11.4	4.1	51.1	26.4	22.5	12.9
	IIB32	42–55	18.6	17.1	9.7	14.1	4.0	63.5	21.4	15.1	5.6
	IIB33	55–65	11.6	11.4	6.1	11.7	5.7	46.5	27.5	26.0	13.1
	IIC1	65–68	.5	2.1	14.5	47.9	8.1	73.1	8.9	18.0	11.4
	IIC2	68–80	2.1	6.0	9.7	15.6	7.3	40.7	33.5	25.8	13.1
	IIC3	80–91	3.4	4.5	3.7	9.8	8.6	30.0	48.2	21.8	9.2

[1] ND means not determined.

Hillsboro is near the center of Highland County, and its weather data are representative of the entire county. Table 11 gives temperature and precipitation data for the county, and table 12 gives probabilities of the last freezing temperatures in spring and the first in fall.

The normal average annual temperature for Highland County is about 2° below the average for southwest Ohio. In 8 or 10 years, it is in the range of 51.0 to 54.6° F. On nights when skies are clear and winds are light, a large variation in surface temperatures occurs within Highland County, mainly near the hills. The daily range in temperature is usually greatest late in summer and early in fall and least in winter. Annual extremes in temperature normally occur soon after June 21 and December 22. In Highland County, the highest temperature during the year is equal to or greater than 91° in 1 of 10 years, 96° in 5 of 10 years, and 101° in 1 of 10 years. The lowest temperature during the year is equal to or

TABLE 11.—*Temperature and precipitation data*

[All data from Hillsboro]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Average highest temperature	Average lowest temperature	Average	One year in 10 will have—		Average snowfall	Average number of days with snow cover of 1 inch or more
						Less than—	More than—		
	°F	°F	°F	°F	*Inches*	*Inches*	*Inches*	*Inches*	
January	40.0	21.9	60	−2	3.69	1.34	6.52	6.3	2
February	41.3	22.3	63	0	2.87	1.00	5.18	5.5	2
March	52.1	31.1	73	12	4.46	1.61	7.90	3.6	1
April	63.4	40.3	82	23	3.87	1.92	6.13	.6	0
May	73.6	50.3	87	34	3.82	1.64	6.39	0	0
June	81.7	59.0	92	44	4.11	1.79	6.86	0	0
July	85.6	62.6	94	50	4.27	1.44	7.78	0	0
August	84.2	61.0	93	48	3.87	1.48	6.76	0	0
September	79.1	54.7	91	38	3.01	.96	5.58	0	0
October	67.8	43.4	83	26	2.44	.71	4.63	.1	0
November	53.2	32.9	72	15	2.97	1.17	5.15	1.5	1
December	41.5	24.3	61	3	3.07	1.29	5.19	4.5	2
Year	63.6	41.9	[1] 96	[2] −6	42.45	33.08	52.54	22.1	8

[1] Average annual highest temperature.
[2] Average annual lowest temperature.

data—Continued

Texture	Reaction	Organic-matter content	Calcium carbonate equivalent	Extractable cations				Sum of extractable cations	Sum of bases	Base saturation (sum)
				H	Ca	Mg	K			
	pH	*Percent*	*Percent*	*Meq per 100 grams of soil*	*Meq per 100 grams of soil*	*Meq per 100 grams of soil*	*Meq per 100 grams of soil*	*Meq per 100 grams of soil*	*Meq per 100 grams of soil*	*Percent*
Silt loam	5.2	2.2	----------	10.3	2.3	.5	.18	13.3	3.0	22
Silt loam	5.4	.8	----------	7.7	3.8	.9	.14	12.5	4.8	39
Silt loam	5.3	.5	----------	8.2	4.6	1.1	.21	14.1	5.9	42
Silty clay loam	5.0	.3	----------	10.6	4.4	1.5	.30	16.8	6.2	37
Loam	4.9	.3	----------	10.4	3.1	1.9	.30	15.7	5.3	34
Sandy clay loam	5.1	.5	----------	11.4	4.3	2.6	.35	18.6	7.2	39
Sandy clay loam	5.2	.5	----------	8.6	4.1	2.5	.28	15.5	6.9	44
Coarse sandy loam	5.6	.5	----------	4.8	3.2	.7	.14	8.8	4.0	46
Sandy clay loam	6.0	.8	----------	7.1	7.2	3.1	.24	17.6	10.5	60
Fine sandy loam	6.2	.5	----------	4.3	5.0	2.1	.20	11.6	7.3	63
Loam	6.6	.5	----------	4.8	7.6	2.6	.21	15.2	10.4	68
Loam	7.7	----------	16.0	----------	----------	----------	----------	----------	----------	----------

less than 2° in 9 of 10 years, 6° below zero in 5 of 10 years, and 16° below zero in 1 of 10 years.

Precipitation in Highland County varies widely from year to year. It is normally abundant and well distributed throughout the year, and fall is the driest season. In 1 year out of 5, the annual precipitation is 40.17 to 44.01 inches, and in 4 years of 5 it is 33.08 to 52.54. Most of the rainfall during the growing season is received as showers and thundershowers. The average number of days each year on which 0.01 inch of precipitation can be expected is 109; 0.10 inch, on 78; 0.50 inch, on 29; and 1.00 inch or more, on 9 days. Heavy rains of 2.4 inches can be expected at least once in 2 years; 3.3 inches at least once in 5 years; 4.0 inches at least once in 10 years, 4.8 inches at least once in 25 years; 5.4 inches at least once in 50 years; and 6.0 inches at least once in 100 years. Most precipitation during the winter comes in the form of rain, but during any year the amount of snowfall may fluctuate widely from the monthly and annual means.

Soil moisture goes through a seasonal cycle each year that is almost independent of the amount of precipitation received. It reaches its lowest point in October and is replenished during winter and spring, when precipitation exceeds water loss by evaporation. In July and August when the water needs of all crops reach a maximum and rainfall is always insufficient to meet those needs, there is a progressive drying of all soils.

During the warm months evaporation is the greatest and consequently the most critical for agriculture. A drought may occur when evaporation greatly exceeds precipitation for a long period of time. Since 1929, the Palmer Drought Severity Index has indicated extended periods of moderate to extreme drought in southwest Ohio during the growing seasons of 1930, 1934, 1941, 1944, 1951, 1953, 1954, 1960, 1964, and 1965.

Generally, humidity rises and falls inversely with the daily temperature and is lowest in summer and highest in winter. For the year, relative humidity averages about 80

TABLE 12.—*Probabilities of last freezing temperatures in spring and first in fall*

[All data from Hillsboro]

Probability	Dates for given probability and temperature				
	20° F or lower	24° F or lower	28° F or lower	32° F or lower	36° F or lower
Spring:					
1 year in 10 later than	April 4	April 16	April 26	May 10	May 25
2 years in 10 later than	March 29	April 11	April 22	May 6	May 20
5 years in 10 later than	March 17	April 1	April 13	April 26	May 10
Fall:					
1 year in 10 earlier than	October 31	October 21	October 10	September 28	September 18
2 years in 10 earlier than	November 5	October 25	October 14	October 3	September 22
5 years in 10 earlier than	November 17	November 6	October 26	October 15	October 4

percent at 1 a.m. and 7 a.m., 55 percent at 1 p.m. and 70 percent at 7 p.m. Cloudiness is greatest in winter and least in summer. This seasonal variation in cloudiness is most clearly illustrated by the percentage of possible sunshine that is about 70 percent in July and 35 percent in December.

Since 1900, six tornadoes have been reported in Highland County.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well-aerated soil is similar to that in the atmosphere, but that in a poorly aerated oil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The ability of sills to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. In this survey the available water capacity is rated to a depth of 40 inches or to a layer that restricts roots. The adjectives used to express available water capacity in this survey are:

Very low	Less than 2.4 inches
Low	2.4 to 3.2 inches
Medium	3.2 to 5.2 inches
High	More than 5.2 inches

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Creep, soil. The downward movement of masses of soil and soil material, mainly through the action of gravity. The movement is generally slow and irregular. It occurs most commonly when the lower part of the soil is nearly saturated with water, and it may be facilitated by alternate freezing and thawing.

Crusty soil. Soil that tends to form a thin, massive or platy surface layer under the beating action of raindrops. The opposite of "crusty" is "self-mulching."

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low available water capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at depth a below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Eluviation. The movement of material from one place to another within the soil, in either true solution or colloidal suspension. Soil horizons that have lost material through eluviation are said to be eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artifically.

Fragipan. A loamy, brittle, subsurface horizon that is very low in organic-matter content and clay but is rich in silt or very fine sand. The layer is seemingly cemented. When dry, it is hard or very hard and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. The layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they generally occur below the B horizon, 15 to 40 inches below the surface.

Glacial outwash (geology). Cross-bedded gravels, sand, and silt deposited by melt-water as it flowed from glacial ice.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice; the deposits are stratified and occur in the form of kames, eskers, deltas, and outwash plains.

Gravelly soil material. From 15 to 50 percent of material, by volume, consists of rounded or angular rock fragments that are not prominently flattened and are as much as 3 inches in diameter.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Illuviation. The accumulation of material in a soil horizon through the deposition of suspended material and organic matter removed from horizons above. Since part of the fine clay in the B horizon (or subsoil) of many soils has moved into the B horizon from the A horizon above, the B horizon is called an illuvial horizon.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is the movement of water through soil layers or material.

Lacustrine deposit (geology). Material deposited in lake water and exposed by lowering of the water level or elevation of the land.

Leaching. The removal of soluble materials from soils or other material by percolating water.

Loam. Soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand.

Loess. Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse;* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Organic matter. A general term for plant and animal material, in or on the soil, in all stages of decomposition. Readily decomposed organic matter is often distinguished from the more stable forms that are past the stage of rapid decomposition.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality of a soil horizon that enables water or air to move through it. It is commonly expressed as inches per hour. The terms used to described permeability in this survey are:

Very slow	Less than 0.06 inch per hour
Slow	0.06 to 0.2 inch per hour
Moderately slow	0.2 to 0.6 inch per hour
Moderate	0.6 to 2.0 inches per hour
Moderately rapid	2.0 to 6.0 inches per hour
Rapid	More than 6.0 inches per hour

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Mildy alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Residual material. Unconsolidated, partly weathered mineral material that accumulates over disintegrating solid rock. Residual material is not soil but is commonly the material in which a soil forms.

Root zone. The part of the soil that is penetrated, or can be penetrated, by plant roots. The adjectives used to describe the root zone in this survey are:

Shallow	Less than 20 inches
Moderately deep	20 to 40 inches
Deep	40 to 60 inches or more

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Stratified. Composed of, or arranged in, strata, or layers, such as stratified alluvium. The term is restricted to geological material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis

of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles) adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks at or near the earth's surface by atmospheric agents. These changes result in more or less complete disintegration and decomposition of the rock.

GUIDE TO MAPPING UNITS

For complete information about a mapping unit, read both the description of the mapping unit and the description of the soil series to which the mapping unit belongs. The system of woodland suitability grouping is explained in the section "Use of the Soils for Woodland."

Map symbol	Mapping unit	Page	Capability unit		Woodland suitability group
			Symbol	Page	Symbol
Ag	Algiers silt loam	103	IIw-1	10	2w1
AtB	Atlas silt loam, 2 to 6 percent slopes	104	IIIw-2	12	2w2
AtB2	Atlas silt loam, 2 to 6 percent slopes, moderately eroded	104	IIIw-2	12	2w2
AtC2	Atlas silt loam, 6 to 12 percent slopes, moderately eroded	104	IVe-3	13	2w2
AtC3	Atlas silt loam, 6 to 12 percent slopes, severely eroded	104	IVe-3	13	2w2
AvA	Avonburg silt loam, 0 to 2 percent slopes	106	IIIw-1	12	2w2
AvB	Avonburg silt loam, 2 to 6 percent slopes	106	IIIw-2	12	2w2
AxA	Avonburg-Urban land complex, nearly level	106	Not assigned	--	Not assigned
BeC2	Beasley silt loam, 6 to 12 percent slopes, moderately eroded	107	IVe-3	13	3c1
BeD2	Beasley silt loam, 12 to 18 percent slopes, moderately eroded	107	VIe-2	14	3c2
BgF	Berks-Muskingum channery silt loams, 18 to 35 percent slopes	108	VIe-3	14	4f1
BgG	Berks-Muskingum channery silt loams, 35 to 50 percent slopes	108	VIIe-2	15	4f2
BhD	Berks-Muskingum-Neotoma channery silt loams, 6 to 18 percent slopes	108	IVe-5	14	4f1
BhF	Berks-Muskingum-Neotoma channery silt loams, 18 to 35 percent slopes	108	VIe-3	14	4f1
BhG	Berks-Muskingum-Neotoma channery silt loams, 35 to 50 percent slopes	109	VIIe-2	15	4f2
Bk	Blanchester silt loam	110	IIw-4	10	2w1
BmC2	Boston-Bratton complex, 6 to 12 percent slopes, moderately eroded	111	IIIe-1	11	2o1
BmC3	Boston-Bratton complex, 6 to 12 percent slopes, severely eroded	111	IVe-1	13	2o1
BmD2	Boston-Bratton complex, 12 to 18 percent slopes, moderately eroded	111	IVe-1	13	2r1
BmD3	Boston-Bratton complex, 12 to 18 percent slopes, severely eroded	111	VIe-2	14	2r1
BmE2	Boston-Bratton complex, 18 to 25 percent slopes, moderately eroded	112	VIe-2	14	2r1
BnB	Boston-Grayford silt loams, 2 to 6 percent slopes	112	IIe-1	9	2o1
BnB2	Boston-Grayford silt loams, 2 to 6 percent slopes, moderately eroded	112	IIe-1	9	2o1
BoB	Boston-Urban land complex, gently sloping	112	Not assigned	--	Not assigned
BoC	Boston-Urban land complex, sloping	112	Not assigned	--	Not assigned
BpB	Bratton silt loam, 2 to 6 percent slopes	113	IIe-1	9	2c1
BpB2	Bratton silt loam, 2 to 6 percent slopes, moderately eroded	113	IIe-1	9	2c1
BpC2	Bratton silt loam, 6 to 12 percent slopes, moderately eroded	114	IIIe-1	11	2c1
BpD2	Bratton silt loam, 12 to 18 percent slopes, moderately eroded	114	IVe-3	13	2c2
BrD3	Bratton silty clay loam, 12 to 18 percent slopes, severely eroded	114	VIe-2	14	2c2
Bs	Brookston silt loam	115	IIw-4	10	2w1
Bt	Brookston silty clay loam	115	IIw-4	10	2w1
CaB	Cana silt loam, 2 to 6 percent slopes	116	IIe-4	10	3o1

Map symbol	Mapping unit	Page	Capability unit		Woodland suitability group
			Symbol	Page	Symbol
CaC2	Cana silt loam, 6 to 12 percent slopes, moderately eroded	116	IIIe-5	12	3o1
CaD2	Cana silt loam, 12 to 18 percent slopes, moderately eroded	117	IVe-5	14	3r1
CaF	Cana silt loam, 18 to 35 percent slopes	117	VIe-3	14	3r1
CcD3	Casco gravelly loam, 12 to 18 percent slopes, severely eroded	118	VIe-1	14	3f1
CcF2	Casco gravelly loam, 18 to 35 percent slopes, moderately eroded	118	VIIe-1	15	3f1
CeB	Celina silt loam, 2 to 6 percent slopes	119	IIe-1	9	2o1
CfB	Celina-Urban land complex, gently sloping	119	Not assigned	--	Not assigned
CgA	Celina-Xenia silt loams, 0 to 2 percent slopes	119	I-1	9	2o1
CgB	Celina-Xenia silt loams, 2 to 6 percent slopes	119	IIe-1	9	2o1
ChB	Cincinnati silt loam, 2 to 6 percent slopes	120	IIe-1	9	2o1
ChC2	Cincinnati silt loam, 6 to 12 percent slopes, moderately eroded	120	IIIe-1	11	2o1
ChD2	Cincinnati silt loam, 12 to 18 percent slopes, moderately eroded	121	IVe-1	13	2r1
Cn	Clermont silt loam	122	IIIw-4	13	2w1
CoD2	Colyer-Trappist complex, 12 to 18 percent slopes, moderately eroded	123	VIs-1	15	4d2
CoF	Colyer-Trappist complex, 18 to 35 percent slopes	123	VIIs-1	15	4d2
CoG	Colyer-Trappist complex, 35 to 50 percent slopes	123	VIIs-1	15	5d1
CrA	Crosby silt loam, 0 to 2 percent slopes	124	IIw-2	10	3w1
CsA	Crosby-Fincastle silt loams, 0 to 2 percent slopes	124	IIw-2	10	3w1
CsB	Crosby-Fincastle silt loams, 2 to 6 percent slopes	124	IIw-2	10	3w1
CuA	Crosby-Urban land complex, nearly level	125	Not assigned	--	Not assigned
DaA	Dana silt loam, 0 to 2 percent slopes	125	I-1	9	2o1
DaB	Dana silt loam, 2 to 6 percent slopes	126	IIe-1	9	2o1
DuA	Dubois silt loam, 0 to 2 percent slopes	127	IIIw-1	12	2w2
DuB	Dubois silt loam, 2 to 6 percent slopes	127	IIIw-1	12	2w2
EbC2	Edenton silt loam, 6 to 12 percent slopes, moderately eroded	128	IIIe-3	11	4d1
EbD2	Edenton silt loam, 12 to 18 percent slopes, moderately eroded	128	IVe-3	13	3r1
EbF2	Edenton silt loam, 18 to 35 percent slopes, moderately eroded	128	VIe-2	14	3r1
Ee	Eel silt loam	129	IIw-5	10	1o1
FcA	Fitchville silt loam, 0 to 2 percent slopes	131	IIw-2	10	2w2
FcB	Fitchville silt loam, 2 to 6 percent slopes	131	IIw-2	10	2w2
FlC2	Fox loam, 6 to 12 percent slopes, moderately eroded	132	IIIe-4	11	2o1
FlD2	Fox loam, 12 to 18 percent slopes, moderately eroded	132	IVe-4	13	2r1
FnA	Fox silt loam, 0 to 2 percent slopes	132	IIs-1	11	2o1
FnB	Fox silt loam, 2 to 6 percent slopes	132	IIe-3	9	2o1
FoC3	Fox clay loam, 6 to 12 percent slopes, severely eroded	133	IVe-4	13	2o1
GaC	Gasconade silty clay loam, 6 to 12 percent slopes	133	IVe-6	14	4d1
GaD2	Gasconade silty clay loam, 12 to 18 percent slopes, moderately eroded	133	VIs-1	15	4d2
GbF2	Gasconade flaggy silty clay loam, 18 to 35 percent slopes, moderately eroded	133	VIIs-1	15	4x1
GbG	Gasconade flaggy silty clay loam, 35 to 50 percent slopes	134	VIIs-1	15	4x1
Gn	Genesee silt loam	135	IIw-5	10	1o1
GuB	Guernsey silt loam, 2 to 6 percent slopes	136	IIw-2	9	2w2
GuC	Guernsey silt loam, 6 to 12 percent slopes	137	IIIe-2	11	2w2
GvC3	Guernsey silty clay loam, 6 to 12 percent slopes, severely eroded	137	IVe-3	13	2w2

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit		Woodland suitability group
			Symbol	Page	Symbol
GxD3	Guernsey soils, 12 to 18 percent slopes, severely eroded	137	VIe-2	14	2w3
HbA	Haubstadt silt loam, 0 to 2 percent slopes	138	IIw-3	10	2o1
HbB	Haubstadt silt loam, 2 to 6 percent slopes	138	IIe-2	9	2o1
HbC2	Haubstadt silt loam, 6 to 12 percent slopes, moderately eroded	138	IIIe-2	11	2o1
HbC3	Haubstadt silt loam, 6 to 12 percent slopes, severely eroded	138	IVe-2	13	2o1
HbD2	Haubstadt silt loam, 12 to 18 percent slopes, moderately eroded	139	IVe-2	13	2r1
HbD3	Haubstadt silt loam, 12 to 18 percent slopes, severely eroded	139	VIe-1	14	2r1
HcB	Haubstadt-Urban land complex, gently sloping	139	Not assigned	--	Not assigned
HcC	Haubstadt-Urban land complex, sloping	139	Not assigned	--	Not assigned
HeF2	Hennepin-Miamian silt loams, 18 to 35 percent slopes, moderately eroded	140	VIe-1	14	2r1
HeG2	Hennepin-Miamian silt loams, 35 to 50 percent slopes, moderately eroded	140	VIIe-1	15	2r1
HfE3	Hennepin-Miamian complex, 12 to 25 percent slopes, severely eroded	140	VIe-1	14	2r1
HkC2	Hickory silt loam, 6 to 12 percent slopes, moderately eroded	142	IIIe-1	11	2o1
HkD2	Hickory silt loam, 12 to 18 percent slopes, moderately eroded	142	IVe-1	13	2r1
HkE2	Hickory silt loam, 18 to 25 percent slopes, moderately eroded	142	VIe-1	14	2r1
HkF2	Hickory silt loam, 25 to 35 percent slopes, moderately eroded	142	VIe-1	14	2r1
HyC3	Hickory clay loam, 6 to 12 percent slopes, severely eroded	142	IVe-1	13	2o1
HyD3	Hickory clay loam, 12 to 18 percent slopes, severely eroded	142	VIe-1	14	2r1
HyE3	Hickory clay loam, 18 to 25 percent slopes, severely eroded	142	VIe-1	14	2r1
JeD	Jessup silt loam, 12 to 18 percent slopes	143	IVe-3	13	3o2
JoC	Johnsburg silt loam, 2 to 8 percent slopes	144	IIe-2	9	4w1
KeB	Kendallville silt loam, 2 to 6 percent slopes	145	IIe-1	9	2o1
KeC2	Kendallville silt loam, 6 to 12 percent slopes, moderately eroded	145	IIIe-1	11	2o1
KeD2	Kendallville silt loam, 12 to 18 percent slopes, moderately eroded	145	IVe-1	13	2r1
KfD3	Kendallville clay loam, 12 to 18 percent slopes, severely eroded	146	VIe-1	14	2r1
LhB	Lawshe silty clay loam, 2 to 6 percent slopes	146	IIIe-3	11	3c1
LhC2	Lawshe silty clay loam, 6 to 12 percent slopes, moderately eroded	146	IVe-6	14	3c1
LhD2	Lawshe silty clay loam, 12 to 18 percent slopes, moderately eroded	147	VIe-2	14	3c2
LlD3	Lawshe silty clay, 12 to 18 percent slopes, severely eroded	147	VIe-2	14	3c2
LoB	Loudon silt loam, 2 to 6 percent slopes	148	IIe-2	9	3c1
LoB2	Loudon silt loam, 2 to 6 percent slopes, moderately eroded	148	IIe-2	9	3c1
LoC2	Loudon silt loam, 6 to 12 percent slopes, moderately eroded	148	IIIe-2	11	3c1
LoD2	Loudon silt loam, 12 to 18 percent slopes, moderately eroded	149	IVe-3	13	3c2

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit		Woodland suitability group
			Symbol	Page	Symbol
LpE2	Loudon-Edenton silt loams, 18 to 25 percent slopes, moderately eroded	149	VIe-2	14	3r1
MdB	Markland silt loam, 2 to 6 percent slopes	150	IIIe-3	11	2o1
MdC2	Markland silt loam, 6 to 12 percent slopes, moderately eroded	150	IVe-3	13	2o1
MdD2	Markland silt loam, 12 to 18 percent slopes, moderately eroded	150	VIe-1	14	2r1
MgB	McGary silt loam, 0 to 4 percent slopes	151	IIIw-2	12	3w1
MlB	Miamian silt loam, 2 to 6 percent slopes	152	IIe-1	9	2o1
MlB2	Miamian silt loam, 2 to 6 percent slopes, moderately eroded	152	IIe-1	9	2o1
MlC2	Miamian silt loam, 6 to 12 percent slopes, moderately eroded	152	IIIe-1	11	2o1
MlD2	Miamian silt loam, 12 to 18 percent slopes, moderately eroded	152	IVe-1	13	2r1
MlE	Miamian silt loam, 18 to 25 percent slopes	152	VIe-1	14	2r1
MmC3	Miamian clay loam, 6 to 12 percent slopes, severely eroded	152	IVe-1	13	2o1
MrB	Miamian-Russell silt loams, 2 to 6 percent slopes	152	IIe-1	9	2o1
MrB2	Miamian-Russell silt loams, 2 to 6 percent slopes, moderately eroded	153	IIe-1	9	2o1
MrC2	Miamian-Russell silt loams, 6 to 12 percent slopes, moderately eroded	153	IIIe-1	11	2o1
MsB	Miamian-Urban land complex, gently sloping	153	Not assigned	--	Not assigned
Mt	Millsdale silty clay loam	154	IIIw-3	12	2w1
MuB	Milton silt loam, 2 to 6 percent slopes	155	IIe-1	9	2o1
MuB2	Milton silt loam, 2 to 6 percent slopes, moderately eroded	155	IIe-1	9	2o1
MuC2	Milton silt loam, 6 to 12 percent slopes, moderately eroded	155	IIIe-1	11	2o1
MuD2	Milton silt loam, 12 to 18 percent slopes, moderately eroded	155	IVe-3	13	2r1
MwC3	Milton clay loam, 6 to 12 percent slopes, severely eroded	155	IVe-3	13	2o1
My	Montgomery silty clay loam	156	IIIw-3	12	2w1
NdC	Negley loam, 6 to 12 percent slopes	159	IIIe-4	11	2o1
NdD	Negley loam, 12 to 18 percent slopes	159	IVe-4	13	2r1
NdE	Negley loam, 18 to 25 percent slopes	159	VIe-1	14	2r1
NdF	Negley loam, 25 to 35 percent slopes	159	VIIe-1	15	2r1
NeB	Negley silt loam, 2 to 6 percent slopes	159	IIe-3	9	2o1
NfC3	Negley clay loam, 6 to 12 percent slopes, severely eroded	160	IVe-4	13	2o1
NfD3	Negley clay loam, 12 to 18 percent slopes, severely eroded	160	VIe-1	14	2r1
NgF	Negley-Fox complex, 18 to 35 percent slopes	160	VIe-1	14	2r1
NnB	Nicholson silt loam, 2 to 6 percent slopes	162	IIe-2	9	2o1
NnB2	Nicholson silt loam, 2 to 6 percent slopes, moderately eroded	162	IIe-2	9	2o1
NnC2	Nicholson silt loam, 6 to 12 percent slopes, moderately eroded	162	IIIe-2	11	2o1
OcA	Ockley silt loam, 0 to 2 percent slopes	163	I-1	9	1o1
OcB	Ockley silt loam, 2 to 6 percent slopes	163	IIe-1	9	1o1
OcC2	Ockley silt loam, 6 to 12 percent slopes, moderately eroded	164	IIIe-1	11	1o1
OdB	Ockley-Urban land complex, gently sloping	164	Not assigned	--	Not assigned
OpD2	Opequon silt loam, 6 to 18 percent slopes, moderately eroded	165	IVe-3	13	3x1

Map symbol	Mapping unit	Page	Capability unit		Woodland suitability group
			Symbol	Page	Symbol
OpE2	Opequon silt loam, 18 to 25 percent slopes, moderately eroded	165	VIe-2	14	3x1
OsF2	Opequon stony silt loam, 18 to 35 percent slopes, moderately eroded	165	VIs-1	15	3x1
OsG	Opequon stony silt loam, 35 to 50 percent slopes	165	VIIs-1	15	3x1
OtD3	Opequon clay, 6 to 18 percent slopes, severely eroded	165	IVe-3	13	3x1
OwB	Otwell silt loam, 2 to 6 percent slopes	166	IIe-1	9	2o1
OwC2	Otwell silt loam, 6 to 12 percent slopes, moderately eroded	167	IIIe-1	11	2o1
OwD2	Otwell silt loam, 12 to 18 percent slopes, moderately eroded	167	IVe-1	13	2r1
OwE2	Otwell silt loam, 18 to 25 percent slopes, moderately eroded	167	VIe-1	14	2r1
OwF	Otwell silt loam, 25 to 35 percent slopes	168	VIe-1	14	2r1
Pa	Patton silt loam	169	IIw-4	10	2w1
Pb	Patton silt loam, till substratum	169	IIw-4	10	2w1
Pe	Peoga silt loam	170	IIIw-4	13	2w1
Pn	Philo silt loam	170	IIw-5	10	2w2
Rn	Ross silt loam	171	IIw-5	10	1o1
RpA	Rossmoyne silt loam, 0 to 2 percent slopes	172	IIw-3	10	2o1
RpB	Rossmoyne silt loam, 2 to 6 percent slopes	172	IIe-2	9	2o1
RpB2	Rossmoyne silt loam, 2 to 6 percent slopes, moderately eroded	172	IIe-2	9	2o1
RpC2	Rossmoyne silt loam, 6 to 12 percent slopes, moderately eroded	172	IIIe-2	11	2o1
RpD2	Rossmoyne silt loam, 12 to 18 percent slopes, moderately eroded	172	IVe-2	13	2r1
RsC3	Rossmoyne silty clay loam, 6 to 12 percent slopes, severely eroded	173	IVe-2	13	2o1
RtB	Rossmoyne-Urban land complex, gently sloping	173	Not assigned	--	Not assigned
RuB	Russell silt loam, 2 to 6 percent slopes	174	IIe-1	9	1o1
SaA	Sardinia silt loam, 0 to 2 percent slopes	175	IIw-3	10	2o1
SaB	Sardinia silt loam, 2 to 6 percent slopes	175	IIe-2	9	2o1
SaC2	Sardinia silt loam, 6 to 12 percent slopes, moderately eroded	175	IIIe-2	11	2o1
Sh	Shoals silt loam	176	IIw-1	10	2w1
SlA	Sleeth silt loam, 0 to 2 percent slopes	178	IIw-2	10	2w2
Sn	Sloan silt loam	178	IIIw-3	12	2w1
St	Stonelick loam	179	IIs-2	11	2o1
ThA	Thackery silt loam, 0 to 2 percent slopes	180	I-1	9	1o1
ThB	Thackery silt loam, 2 to 6 percent slopes	180	IIe-1	9	1o1
TrE	Trappist silt loam, 18 to 25 percent slopes	181	IVe-5	14	2r1
TsB	Trappist-Muse silt loams, 2 to 6 percent slopes	181	IIe-4	9	2o1
TsC2	Trappist-Muse silt loams, 6 to 12 percent slopes, moderately eroded	181	IIIe-5	12	2o1
TsD2	Trappist-Muse silt loams, 12 to 18 percent slopes, moderately eroded	181	IVe-5	14	2r1
TuD	Tuscarawas channery silt loam, 6 to 18 percent slopes	182	IVe-5	14	2w3
TuF	Tuscarawas channery silt loam, 18 to 35 percent slopes	183	VIe-3	14	2w3
WaA	Warsaw silt loam, 0 to 2 percent slopes	183	IIs-1	11	2o1
WeA	Wea silt loam, 0 to 2 percent slopes	184	I-1	9	1o1
WeB	Wea silt loam, 2 to 6 percent slopes	184	IIe-1	9	1o1
WlC	Wellston silt loam, 6 to 12 percent slopes	185	IIIe-5	12	2o1
WlD	Wellston silt loam, 12 to 18 percent slopes	185	IVe-5	14	2r1

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit		Woodland suitability group
			Symbol	Page	Symbol
Ws	Westland silt loam, overwash	186	IIw-4	10	2w1
Wt	Westland silty clay loam	186	IIw-4	10	2w1
WvA	Williamsburg silt loam, 0 to 2 percent slopes	188	I-1	9	1o1
WvB	Williamsburg silt loam, 2 to 6 percent slopes	188	IIe-1	9	1o1
WvC	Williamsburg silt loam, 6 to 12 percent slopes	188	IIIe-1	11	1o1
XeB	Xenia silt loam, 2 to 6 percent slopes	189	IIe-1	9	1o1

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

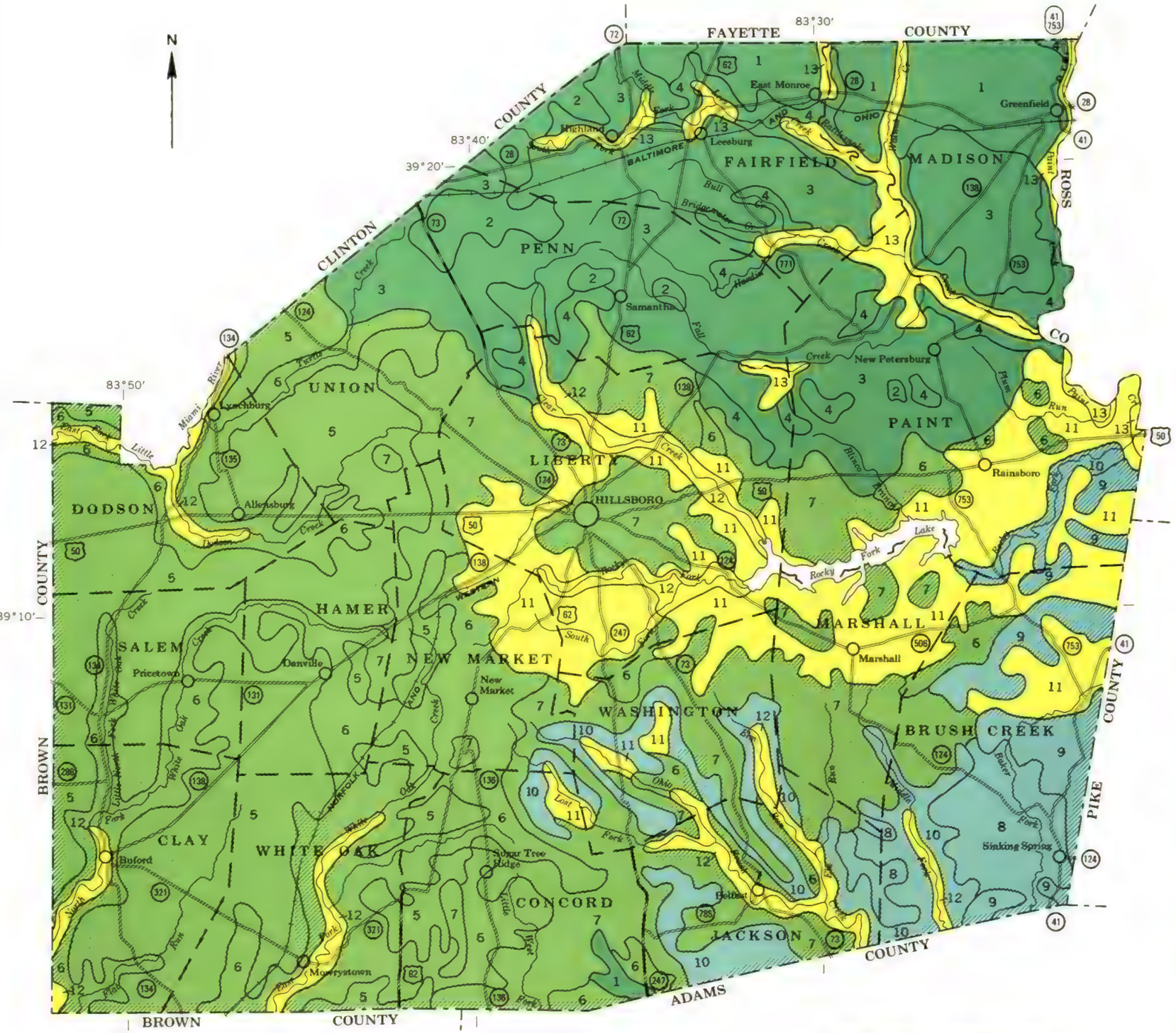
OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF LANDS AND SOIL
OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER

GENERAL SOIL MAP

HIGHLAND COUNTY, OHIO

Scale 1:190,080

1 0 1 2 3 4 Miles



Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SOIL ASSOCIATIONS

SOILS THAT FORMED MAINLY IN WISCONSIN-AGE GLACIAL TILL

1 Miamian-Celina-Brookston association: Deep, nearly level to steep, well drained, moderately well drained, and very poorly drained soils that formed in thin loess and the underlying glacial till

2 Brookston-Crosby-Fincastle association: Deep, nearly level to gently sloping, very poorly drained and somewhat poorly drained soils that formed in thin loess and the underlying glacial till

3 Miamian-Russell-Celina association: Deep, gently sloping to steep, well drained and moderately well drained soils that formed in thin loess and the underlying glacial till

4 Hennepin-Milton-Miamian association: Deep and moderately deep, gently sloping to very steep, well-drained soils that formed in thin silty deposits and the underlying glacial till

SOILS THAT FORMED MAINLY IN ILLIONOIAN-AGE GLACIAL TILL

5 Avonburg-Clermont-Blanchester association: Deep, nearly level to gently sloping, somewhat poorly drained and poorly drained soils that formed in loess and the underlying glacial till

6 Rossmoyne-Hickory association: Deep, nearly level to steep, moderately well drained and well drained soils that formed in loess and the underlying glacial till

7 Boston-Rossmoyne-Bratton association: Deep and moderately deep, nearly level to moderately steep, well drained and moderately well drained soils that formed in loess and the underlying glacial till

SOILS THAT FORMED MAINLY IN RESIDUUM FROM LIMESTONE, SANDSTONE, AND SHALE

8 Bratton-Nicholson-Opequon association: Moderately deep, deep, and shallow, gently sloping to very steep, well drained and moderately well drained soils that formed in loess and the underlying residuum from limestone

9 Colyer-Trappist-Berks association: Shallow and moderately deep, gently sloping to very steep, well-drained soils that formed in residuum weathered from shale and sandstone

10 Opequon-Loudon-Lawshe association: Shallow, deep, and moderately deep, gently sloping to very steep, well drained and moderately well drained soils that formed in residuum from limestone and shale

SOILS THAT FORMED MAINLY IN STRATIFIED, WATER-DEPOSITED MATERIAL

11 Haubstadt-Otwell-Negley association: Deep, gently sloping to steep, moderately well drained and well drained soils that formed in loess and the underlying stratified, water-deposited material

12 Genesee-Algiers-Sardinia association: Deep, nearly level to sloping, well drained, somewhat poorly drained, and moderately well drained soils that formed in alluvium or loess and the underlying water-deposited material

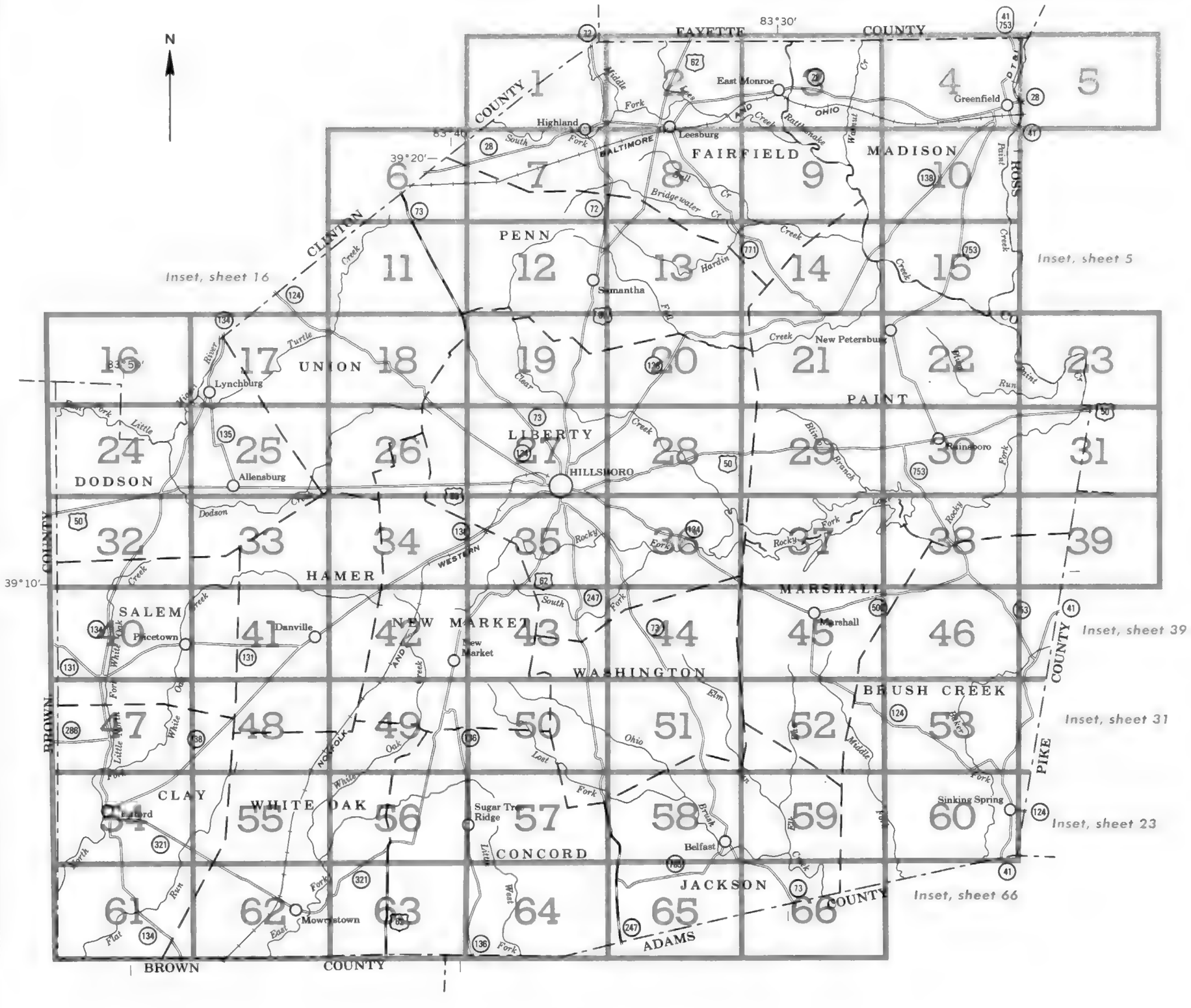
13 Fox-Genesee-Ross association: Deep, nearly level to moderately steep, well-drained soils that formed in stratified glacial outwash or recent alluvium

Compiled 1974

INDEX TO MAP SHEETS
HIGHLAND COUNTY, OHIO

Scale 1:190,080

1 0 1 2 3 4 Miles



SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, F, or G, shows the slope. Symbols without a slope letter are those of nearly level soils. A final number, 2 or 3, in the symbol shows that the soil is moderately eroded or severely eroded.

SYMBOL	NAME
Ag	Algiers silt loam
AtB	Atlas silt loam, 2 to 6 percent slopes
AtB2	Atlas silt loam, 2 to 6 percent slopes, moderately eroded
AtC2	Atlas silt loam, 6 to 12 percent slopes, moderately eroded
AtC3	Atlas silt loam, 6 to 12 percent slopes, severely eroded
AvA	Avonburg silt loam, 0 to 2 percent slopes
AvB	Avonburg silt loam, 2 to 6 percent slopes
AxA	Avonburg-Urban land complex, nearly level
BeC2	Beasley silt loam, 6 to 12 percent slopes, moderately eroded
BeD2	Beasley silt loam, 12 to 18 percent slopes, moderately eroded
BgF	Berks-Muskingum channery silt loams, 18 to 35 percent slopes
BgG	Berks-Muskingum channery silt loams, 35 to 50 percent slopes
BhD	Berks-Muskingum-Neotoma channery silt loams, 6 to 18 percent slopes
BhF	Berks-Muskingum-Neotoma channery silt loams, 18 to 35 percent slopes
BhG	Berks-Muskingum-Neotoma channery silt loams, 35 to 50 percent slopes
Bk	Blanchester silt loam
BmC2	Boston-Bratton complex, 6 to 12 percent slopes, moderately eroded
BmC3	Boston-Bratton complex, 6 to 12 percent slopes, severely eroded
BmD2	Boston-Bratton complex, 12 to 18 percent slopes, moderately eroded
BmD3	Boston-Bratton complex, 12 to 18 percent slopes, severely eroded
BmE2	Boston-Bratton complex, 18 to 25 percent slopes, moderately eroded
BnB	Boston-Grayford silt loams, 2 to 6 percent slopes
BnB2	Boston-Grayford silt loams, 2 to 6 percent slopes, moderately eroded
BoB	Boston-Urban land complex, gently sloping
BoC	Boston-Urban land complex, sloping
BpB	Bratton silt loam, 2 to 6 percent slopes
BpB2	Bratton silt loam, 2 to 6 percent slopes, moderately eroded
BpC2	Bratton silt loam, 6 to 12 percent slopes, moderately eroded
BpD2	Bratton silt loam, 12 to 18 percent slopes, moderately eroded
BrD3	Bratton silty clay loam, 12 to 18 percent slopes, severely eroded
Bs	Brookston silt loam
Bt	Brookston silty clay loam
CaB	Cana silt loam, 2 to 6 percent slopes
CaC2	Cana silt loam, 6 to 12 percent slopes, moderately eroded
CaD2	Cana silt loam, 12 to 18 percent slopes, moderately eroded
CaF	Cana silt loam, 18 to 35 percent slopes
CcD3	Casco gravelly loam, 12 to 18 percent slopes, severely eroded
CcF2	Casco gravelly loam, 18 to 35 percent slopes, moderately eroded
CeB	Celina silt loam, 2 to 6 percent slopes
CfB	Celina-Urban land complex, gently sloping
CgA	Celina-Xenia silt loams, 0 to 2 percent slopes
CgB	Celina-Xenia silt loams, 2 to 6 percent slopes
ChB	Cincinnati silt loam, 2 to 6 percent slopes
ChC2	Cincinnati silt loam, 6 to 12 percent slopes, moderately eroded
ChD2	Cincinnati silt loam, 12 to 18 percent slopes, moderately eroded
Cm	Clermont silt loam
CoD2	Colyer-Trappist complex, 12 to 18 percent slopes, moderately eroded
CoF	Colyer-Trappist complex, 18 to 35 percent slopes
CoG	Colyer-Trappist complex, 35 to 50 percent slopes
CrA	Crosby silt loam, 0 to 2 percent slopes
CsA	Crosby-Fincastle silt loams, 0 to 2 percent slopes
CsB	Crosby-Fincastle silt loams, 2 to 6 percent slopes
CuA	Crosby-Urban land complex, nearly level
DaA	Dana silt loam, 0 to 2 percent slopes
DaB	Dana silt loam, 2 to 6 percent slopes
DuA	Dubois silt loam, 0 to 2 percent slopes
DuB	Dubois silt loam, 2 to 6 percent slopes
EbC2	Edenton silt loam, 6 to 12 percent slopes, moderately eroded
EbD2	Edenton silt loam, 12 to 18 percent slopes, moderately eroded
EbF2	Edenton silt loam, 18 to 35 percent slopes, moderately eroded
Ee	Eel silt loam
FcA	Fitchville silt loam, 0 to 2 percent slopes
FcB	Fitchville silt loam, 2 to 6 percent slopes
FlC2	Fox loam, 6 to 12 percent slopes, moderately eroded
FlD2	Fox loam, 12 to 18 percent slopes, moderately eroded
FnA	Fox silt loam, 0 to 2 percent slopes
FnB	Fox silt loam, 2 to 6 percent slopes
FoC3	Fox clay loam, 6 to 12 percent slopes, severely eroded
GaC	Gasconade silty clay loam, 6 to 12 percent slopes
GaD2	Gasconade silty clay loam, 12 to 18 percent slopes, moderately eroded
GbF2	Gasconade flaggy silty clay loam, 18 to 35 percent slopes, moderately eroded
GbG	Gasconade flaggy silty clay loam, 35 to 50 percent slopes
Gn	Genesee silt loam
GuB	Guernsey silt loam, 2 to 6 percent slopes
GuC	Guernsey silt loam, 6 to 12 percent slopes
GvC3	Guernsey silty clay loam, 6 to 12 percent slopes, severely eroded
GxD3	Guernsey soils, 12 to 18 percent slopes, severely eroded
HbA	Haubstadt silt loam, 0 to 2 percent slopes
HbB	Haubstadt silt loam, 2 to 6 percent slopes
HbC2	Haubstadt silt loam, 6 to 12 percent slopes, moderately eroded
HbC3	Haubstadt silt loam, 6 to 12 percent slopes, severely eroded
HbD2	Haubstadt silt loam, 12 to 18 percent slopes, moderately eroded
HbD3	Haubstadt silt loam, 12 to 18 percent slopes, severely eroded
HcB	Haubstadt-Urban land complex, gently sloping
HcC	Haubstadt-Urban land complex, sloping
HeF2	Hennepin-Miamian silt loams, 18 to 35 percent slopes, moderately eroded
HeG2	Hennepin-Miamian silt loams, 35 to 50 percent slopes, moderately eroded
HfE3	Hennepin-Miamian complex, 12 to 25 percent slopes, severely eroded
HkC2	Hickory silt loam, 6 to 12 percent slopes, moderately eroded
HkD2	Hickory silt loam, 12 to 18 percent slopes, moderately eroded
HkE2	Hickory silt loam, 18 to 25 percent slopes, moderately eroded
HkF2	Hickory silt loam, 25 to 35 percent slopes, moderately eroded
HyC3	Hickory clay loam, 6 to 12 percent slopes, severely eroded
HyD3	Hickory clay loam, 12 to 18 percent slopes, severely eroded
HyE3	Hickory clay loam, 18 to 25 percent slopes, severely eroded
JeD	Jessup silt loam, 12 to 18 percent slopes
JoC	Johnsburg silt loam, 2 to 8 percent slopes
KeB	Kendallville silt loam, 2 to 6 percent slopes
KeC2	Kendallville silt loam, 6 to 12 percent slopes, moderately eroded
KeD2	Kendallville silt loam, 12 to 18 percent slopes, moderately eroded
KfD3	Kendallville clay loam, 12 to 18 percent slopes, severely eroded
LhB	Lawshe silty clay loam, 2 to 6 percent slopes
LhC2	Lawshe silty clay loam, 6 to 12 percent slopes, moderately eroded
LhD2	Lawshe silty clay loam, 12 to 18 percent slopes, moderately eroded
LlD3	Lawshe silty clay, 12 to 18 percent slopes, severely eroded
LoB	Loudon silt loam, 2 to 6 percent slopes
LoB2	Loudon silt loam, 2 to 6 percent slopes, moderately eroded
LoC2	Loudon silt loam, 6 to 12 percent slopes, moderately eroded
LoD2	Loudon silt loam, 12 to 18 percent slopes, moderately eroded
LpE2	Loudon-Edenton silt loams, 18 to 25 percent slopes, moderately eroded
MdB	Markland silt loam, 2 to 6 percent slopes
MdC2	Markland silt loam, 6 to 12 percent slopes, moderately eroded
MdD2	Markland silt loam, 12 to 18 percent slopes, moderately eroded
MgB	McGary silt loam, 0 to 4 percent slopes
MlB	Miamian silt loam, 2 to 6 percent slopes
MlB2	Miamian silt loam, 2 to 6 percent slopes, moderately eroded
MlC2	Miamian silt loam, 6 to 12 percent slopes, moderately eroded
MlD2	Miamian silt loam, 12 to 18 percent slopes, moderately eroded
MlE	Miamian silt loam, 18 to 25 percent slopes
MmC3	Miamian clay loam, 6 to 12 percent slopes, severely eroded
MrB	Miamian-Russell silt loams, 2 to 6 percent slopes
MrB2	Miamian-Russell silt loams, 2 to 6 percent slopes, moderately eroded
MrC2	Miamian-Russell silt loams, 6 to 12 percent slopes, moderately eroded
MsB	Miamian-Urban land complex, gently sloping
Mt	Millsdale silty clay loam
MuB	Milton silt loam, 2 to 6 percent slopes
MuB2	Milton silt loam, 2 to 6 percent slopes, moderately eroded
MuC2	Milton silt loam, 6 to 12 percent slopes, moderately eroded
MuD2	Milton silt loam, 12 to 18 percent slopes, moderately eroded
MwC3	Milton clay loam, 6 to 12 percent slopes, severely eroded
My	Montgomery silty clay loam
NdC	Negley loam, 6 to 12 percent slopes
NdD	Negley loam, 12 to 18 percent slopes
NdE	Negley loam, 18 to 25 percent slopes
NdF	Negley loam, 25 to 35 percent slopes
NeB	Negley silt loam, 2 to 6 percent slopes
NfC3	Negley clay loam, 6 to 12 percent slopes, severely eroded
NfD3	Negley clay loam, 12 to 18 percent slopes, severely eroded
NgF	Negley-Fox complex, 18 to 35 percent slopes
NnB	Nicholson silt loam, 2 to 6 percent slopes
NnB2	Nicholson silt loam, 2 to 6 percent slopes, moderately eroded
NnC2	Nicholson silt loam, 6 to 12 percent slopes, moderately eroded
OcA	Ockley silt loam, 0 to 2 percent slopes
OcB	Ockley silt loam, 2 to 6 percent slopes
OcC2	Ockley silt loam, 6 to 12 percent slopes, moderately eroded
OdB	Ockley-Urban land complex, gently sloping
OpD2	Opequon silt loam, 6 to 18 percent slopes, moderately eroded
OpE2	Opequon silt loam, 18 to 25 percent slopes, moderately eroded
OsF2	Opequon stony silt loam, 18 to 35 percent slopes, moderately eroded
OsG	Opequon stony silt loam, 35 to 50 percent slopes
OtD3	Opequon clay, 6 to 18 percent slopes, severely eroded
OwB	Otwell silt loam, 2 to 6 percent slopes
OwC2	Otwell silt loam, 6 to 12 percent slopes, moderately eroded
OwD2	Otwell silt loam, 12 to 18 percent slopes, moderately eroded
OwE2	Otwell silt loam, 18 to 25 percent slopes, moderately eroded
OwF	Otwell silt loam, 25 to 35 percent slopes
Pa	Patton silt loam
Pb	Patton silt loam, till substratum
Pe	Peoga silt loam
Pn	Philo silt loam
Rn	Ross silt loam
RpA	Rossmoyne silt loam, 0 to 2 percent slopes
RpB	Rossmoyne silt loam, 2 to 6 percent slopes
RpB2	Rossmoyne silt loam, 2 to 6 percent slopes, moderately eroded
RpC2	Rossmoyne silt loam, 6 to 12 percent slopes, moderately eroded
RpD2	Rossmoyne silt loam, 12 to 18 percent slopes, moderately eroded
RsC3	Rossmoyne silty clay loam, 6 to 12 percent slopes, severely eroded
RtB	Rossmoyne-Urban land complex, gently sloping
RuB	Russell silt loam, 2 to 6 percent slopes
SaA	Sardinia silt loam, 0 to 2 percent slopes
SaB	Sardinia silt loam, 2 to 6 percent slopes
SaC2	Sardinia silt loam, 6 to 12 percent slopes, moderately eroded
Sh	Shoals silt loam
SlA	Sleeth silt loam, 0 to 2 percent slopes
Sn	Sloan silt loam
St	Stonelick loam
ThA	Thackery silt loam, 0 to 2 percent slopes
ThB	Thackery silt loam, 2 to 6 percent slopes
TrE	Trappist silt loam, 18 to 25 percent slopes
TsB	Trappist-Muse silt loams, 2 to 6 percent slopes
TsC2	Trappist-Muse silt loams, 6 to 12 percent slopes, moderately eroded
TsD2	Trappist-Muse silt loams, 12 to 18 percent slopes, moderately eroded
TuD	Tuscarawas channery silt loam, 6 to 18 percent slopes
TuF	Tuscarawas channery silt loam, 18 to 35 percent slopes
WaA	Warsaw silt loam, 0 to 2 percent slopes
WeA	Wea silt loam, 0 to 2 percent slopes
WeB	Wea silt loam, 2 to 6 percent slopes
WlC	Wellston silt loam, 6 to 12 percent slopes
WlD	Wellston silt loam, 12 to 18 percent slopes
Ws	Westland silt loam, overwash
Wt	Westland silty clay loam
WvA	Williamsburg silt loam, 0 to 2 percent slopes
WvB	Williamsburg silt loam, 2 to 6 percent slopes
WvC	Williamsburg silt loam, 6 to 12 percent slopes
XeB	Xenia silt loam, 2 to 6 percent slopes

HIGHLAND COUNTY, OHIO

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church

Mine and quarry (QU)

Gravel pit (G.P.)

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Indian mound

Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals and ditches

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

Short steep slope

Prominent peak

Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully
- City dump
- Gullied land
- Cut and fill land, large areas (C.F.L.)
- Cut and fill land, small areas
- Summer pool line, elevation 798.0

HIGHLAND COUNTY, OHIO — SHEET NUMBER 1

HIGHLAND COUNTY, OHIO NO. 1

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

1 675 000 FEET

505 000 FEET

495 000 FEET

1 690 000 FEET

(Joins sheet 2)

(Joins sheet 7)

N

1 Mile

5000 Feet

Scale 1:15840

CLINTON COUNTY

FAYETTE COUNTY

FAIRFIELD

Middle Fork

South Fork

Creek

LARRICK ROAD

ANTIOCH ROAD

MIC2 CgB

HeF2

OcB

MIC2

HIGHLAND COUNTY, OHIO — SHEET NUMBER 2

(2)

N

1 Mile

5000 Feet

Scale 1:15840

1 710 000 FEET

1 700 000 FEET

1 695 000 FEET

FAYETTE COUNTY

(Joins sheet 1)

(Joins sheet 3)

(Joins sheet 8)

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone

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HIGHLAND COUNTY, OHIO NO. 2

HIGHLAND COUNTY, OHIO NO. 3

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Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

HIGHLAND COUNTY, OHIO — SHEET NUMBER 4

4

N

1 Mile

5,000 Feet

Scale 1:15840

1,750,000 FEET

1,500,000 FEET

1,450,000 FEET

FAYETTE COUNTY

MADISON

ROSS CO

PAINT CREEK

GREENFIELD

McClain High School

Hospital

CITY DUMP

Farmers Run

Sugar Run

TOLEDO AND DETROIT

BALTIMORE AND OHIO

(Joins sheet 3)

(Joins sheet 5)

(Joins sheet 10)

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

HIGHLAND COUNTY, OHIO NO. 4

HIGHLAND COUNTY, OHIO NO. 5

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

HIGHLAND COUNTY, OHIO — SHEET NUMBER 6

(6)

N

1 Mile

5000 Feet

0 ¼ ½ ¾ 1

Scale 1:15840

1 480 000 FEET

1 655 000 FEET

1 670 000 FEET

490 000 FEET

(Joins sheet 7)

(Joins sheet 11)

FAIRFIELD

UNION

CLINTON COUNTY

BALTIMORE AND OHIO

CsB MIB2 MIC2 MrB CgB CsA Bs Sn Ag Bt

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone

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HIGHLAND COUNTY, OHIO NO. 6

HIGHLAND COUNTY, OHIO — SHEET NUMBER 7

HIGHLAND COUNTY, OHIO NO. 7

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

1 675 000 FEET

490 000 FEET

(Joins sheet 1)

(Joins sheet 6)

(Joins sheet 8)

(Joins sheet 12)

480 000 FEET

1 690 000 FEET

7

N

1 Mile

5000 Feet

Scale 1:15840

1 0 1000 2000 3000 4000 5000

HIGHLAND COUNTY, OHIO — SHEET NUMBER 8

8

N

1 Mile

5000 Feet

Scale 1:15840

(Joins sheet 2)

(Joins sheet 7)

(Joins sheet 13)

(Joins sheet 9)

1 710 000 FEET

1 695 000 FEET

490 000 FEET

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center

HIGHLAND COUNTY OHIO NO 8

HIGHLAND COUNTY, OHIO NO. 9

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

HIGHLAND COUNTY, OHIO — SHEET NUMBER 10

(10)

N

1 Mile

5 000 Feet

Scale 1:15840

(Joins sheet 9)

(Joins sheet 4)

(Joins sheet 15)

1 735 000 FEET

1 750 000 FEET

480 000 FEET

485 000 FEET

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

HIGHLAND COUNTY OHIO NO 10

HIGHLAND COUNTY, OHIO NO. 11

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone

(Joins inset, sheet 16)
(Joins sheet 6)
(Joins sheet 12)
(Joins sheet 18)

1 655 000 FEET
1 670 000 FEET
425 000 FEET

CLINTON COUNTY
FETTERLING CEM
UNDERWOOD CEM
Mt Olive Church
MAD RIVER
POWELL ROAD

11

N

1 Mile
5 000 Feet

Scale 1:15840

HIGHLAND COUNTY, OHIO — SHEET NUMBER 12

N

Scale 1:15840

1 Mile

5000 Feet

0 1000 2000 3000 4000 5000

0 ¼ ½ ¾ 1

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

HIGHLAND COUNTY, OHIO NO. 12

HIGHLAND COUNTY, OHIO NO. 13

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

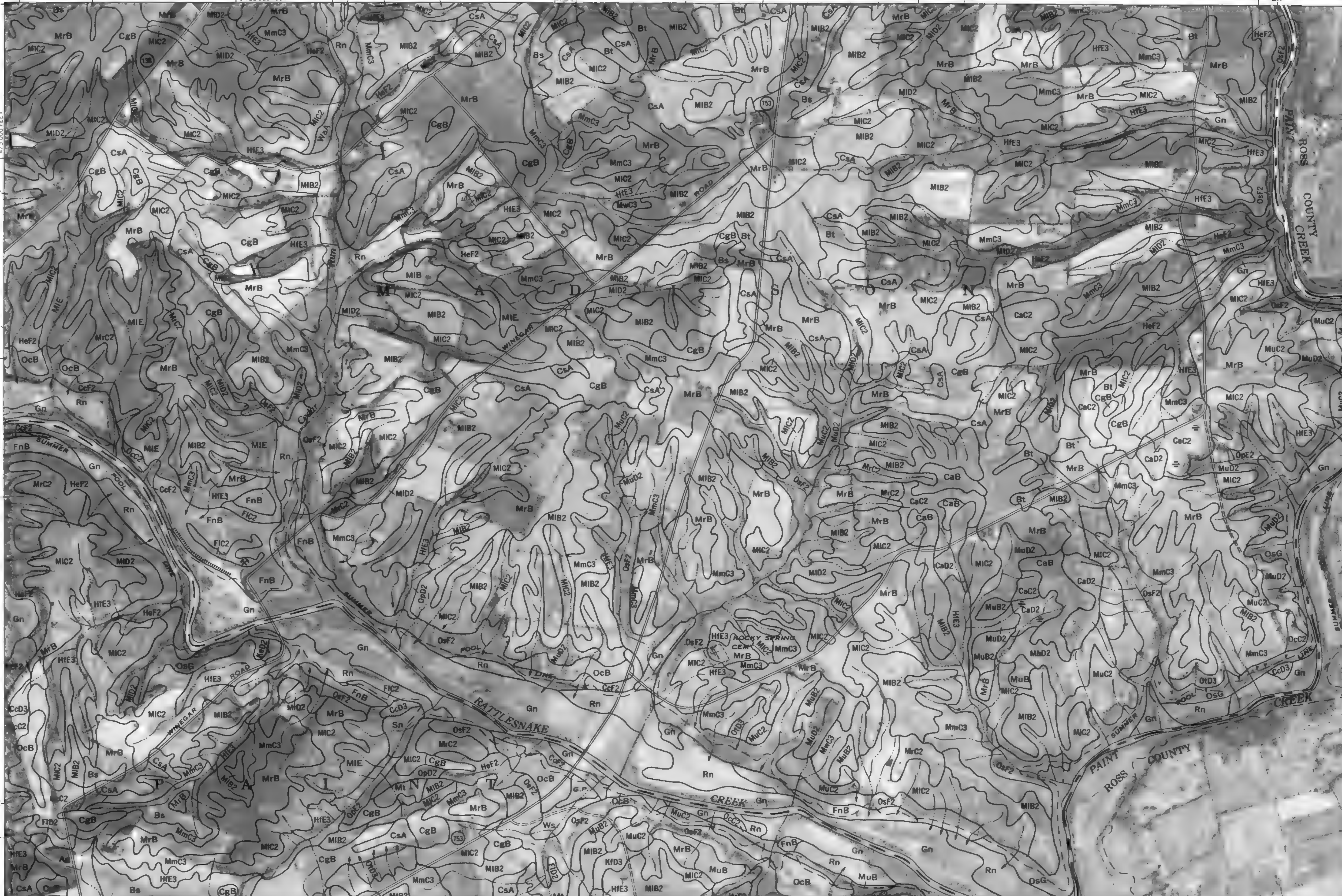
HIGHLAND COUNTY, OHIO — SHEET NUMBER 14

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

HIGHLAND COUNTY, OHIO NO. 14

(Joins sheet 10)



(Joins sheet 14)

(Joins inset, sheet 5)

(Joins sheet 22)

N

Scale 1:15840

1 Mile

5000 Feet

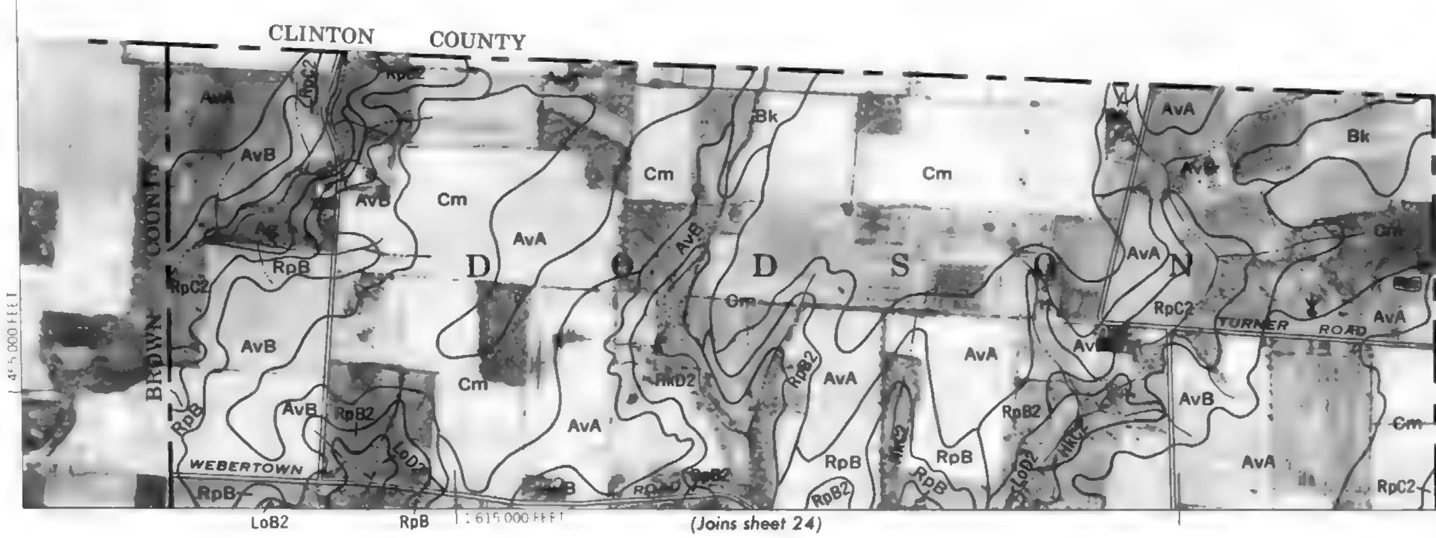
HIGHLAND COUNTY, OHIO NO. 15

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

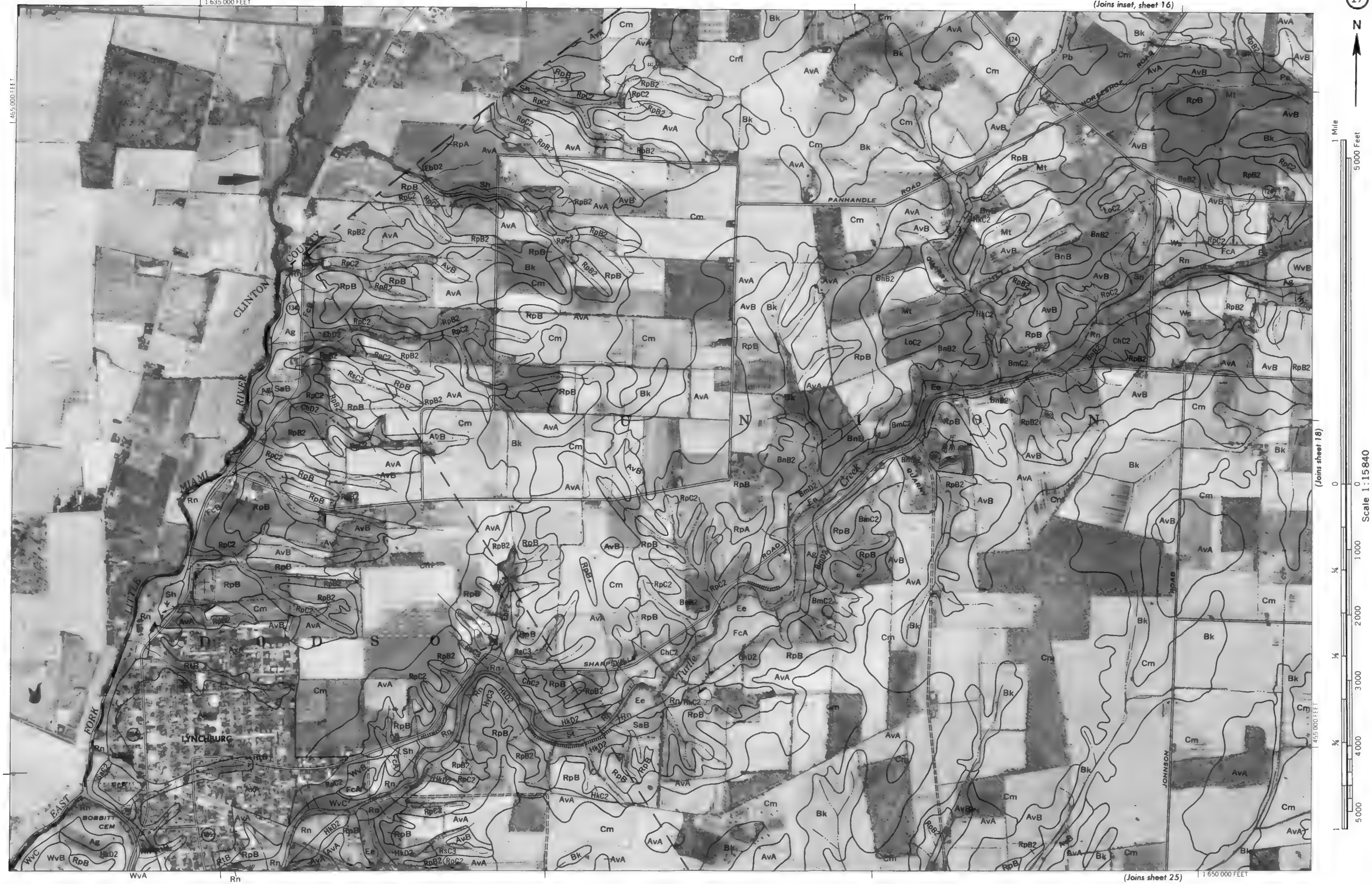
HIGHLAND COUNTY, OHIO — SHEET NUMBER 16

N

1 Mile
5000 Feet
Scale 1:15840
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000



Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.
This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center

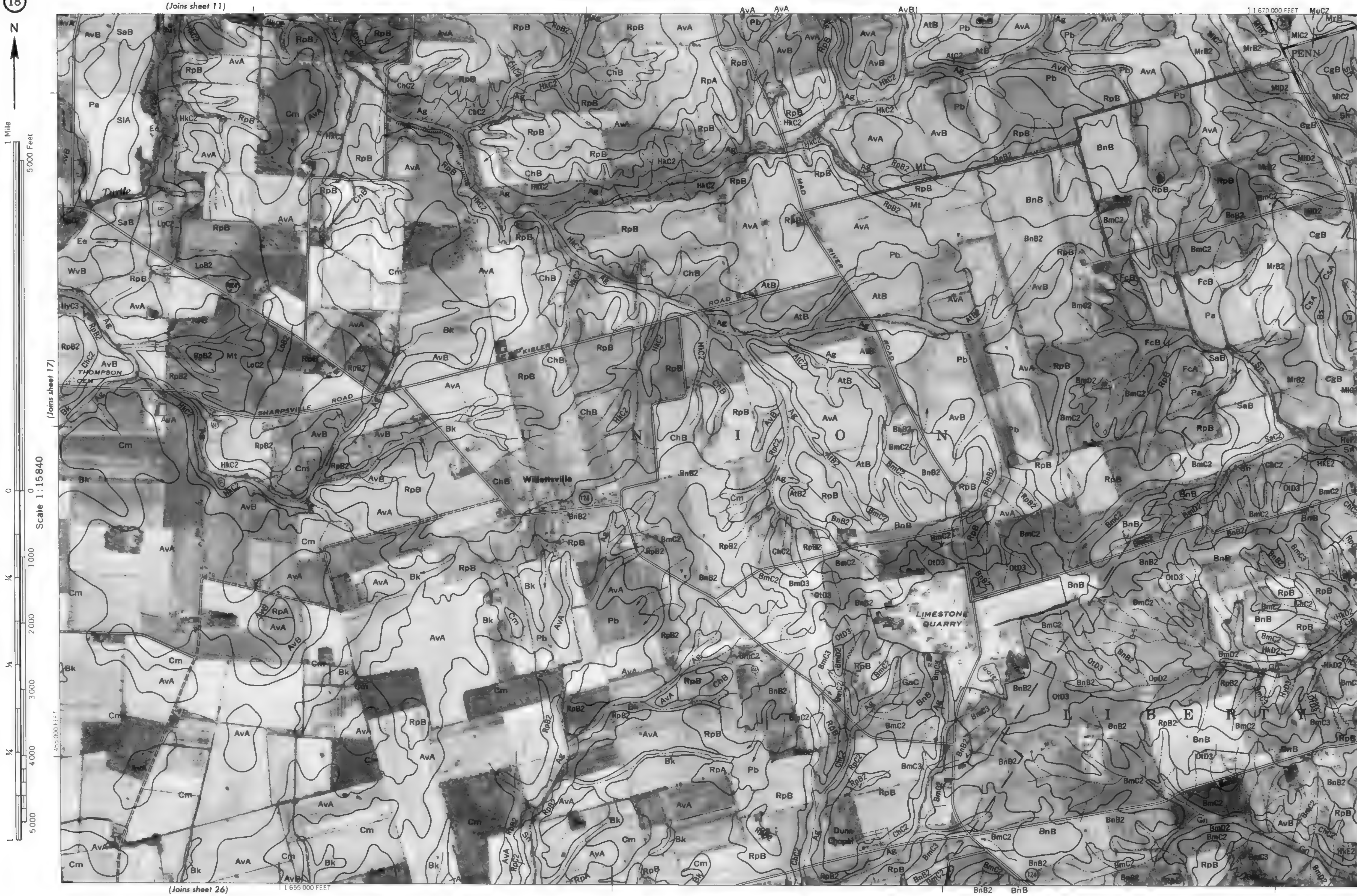


HIGHLAND COUNTY, OHIO NO. 17

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

HIGHLAND COUNTY, OHIO — SHEET NUMBER 18



Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center

HIGHLAND COUNTY, OHIO — SHEET NUMBER 19

HIGHLAND COUNTY, OHIO NO. 19

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

(Joins sheet 18)

(Joins sheet 12)

(Joins sheet 20)

(Joins sheet 27)

PENN

1 675 000 FEET

465 000 FEET

455 000 FEET

1 690 000 FEET

19

N

Scale 1:15840

1 Mile

5000 Feet

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center

HIGHLAND COUNTY OHIO NO 20

HIGHLAND COUNTY, OHIO — SHEET NUMBER 21

HIGHLAND COUNTY, OHIO NO. 21

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

1 715 000 FEET

460 000 FEET

(Joins sheet 14)

(Joins sheet 20)

(Joins sheet 22)

(Joins sheet 29)

1 730 000 FEET

455 000 FEET

21

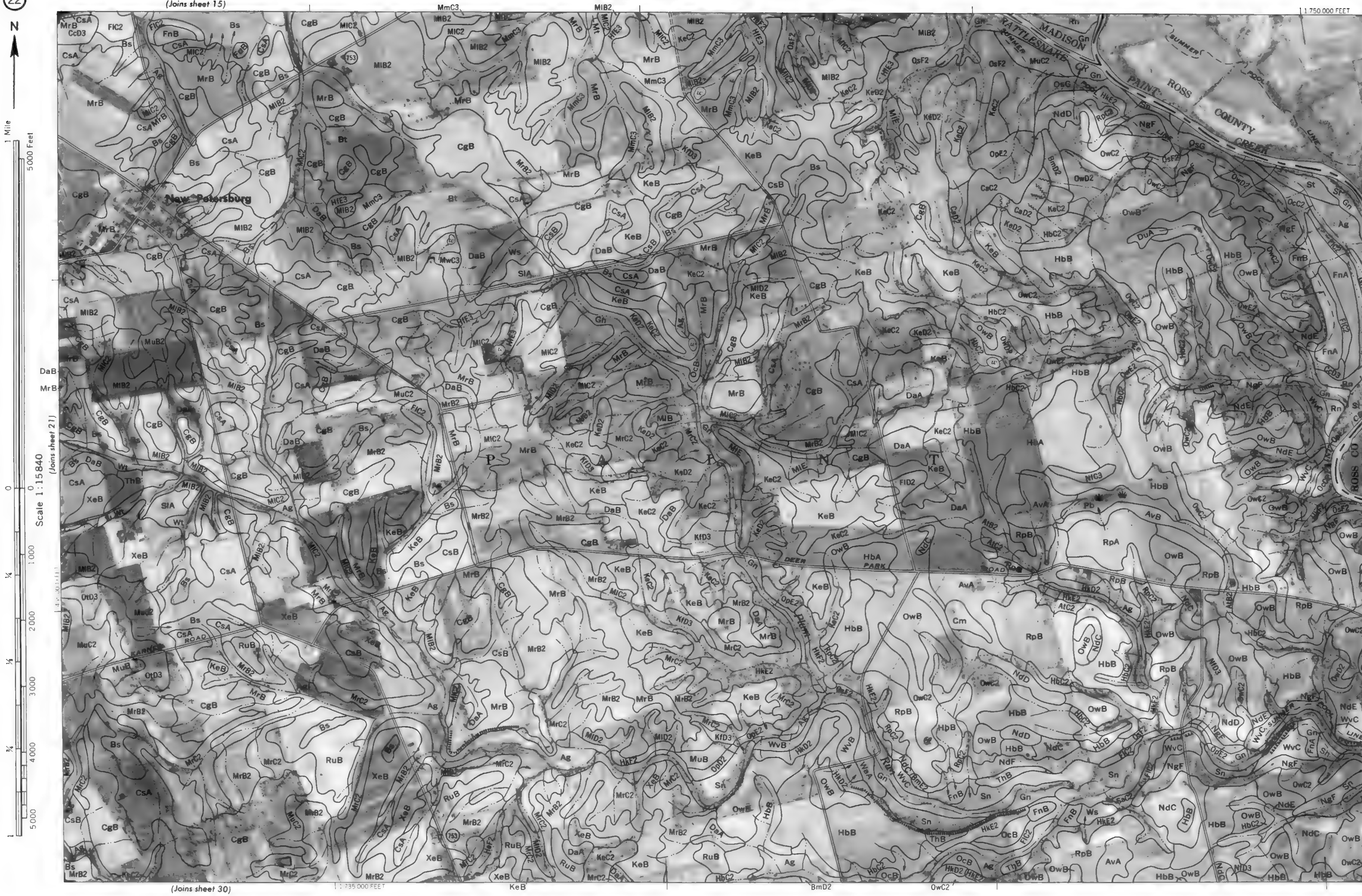
N

1 Mile

5000 Feet

Scale 1:15840

HIGHLAND COUNTY, OHIO — SHEET NUMBER 22



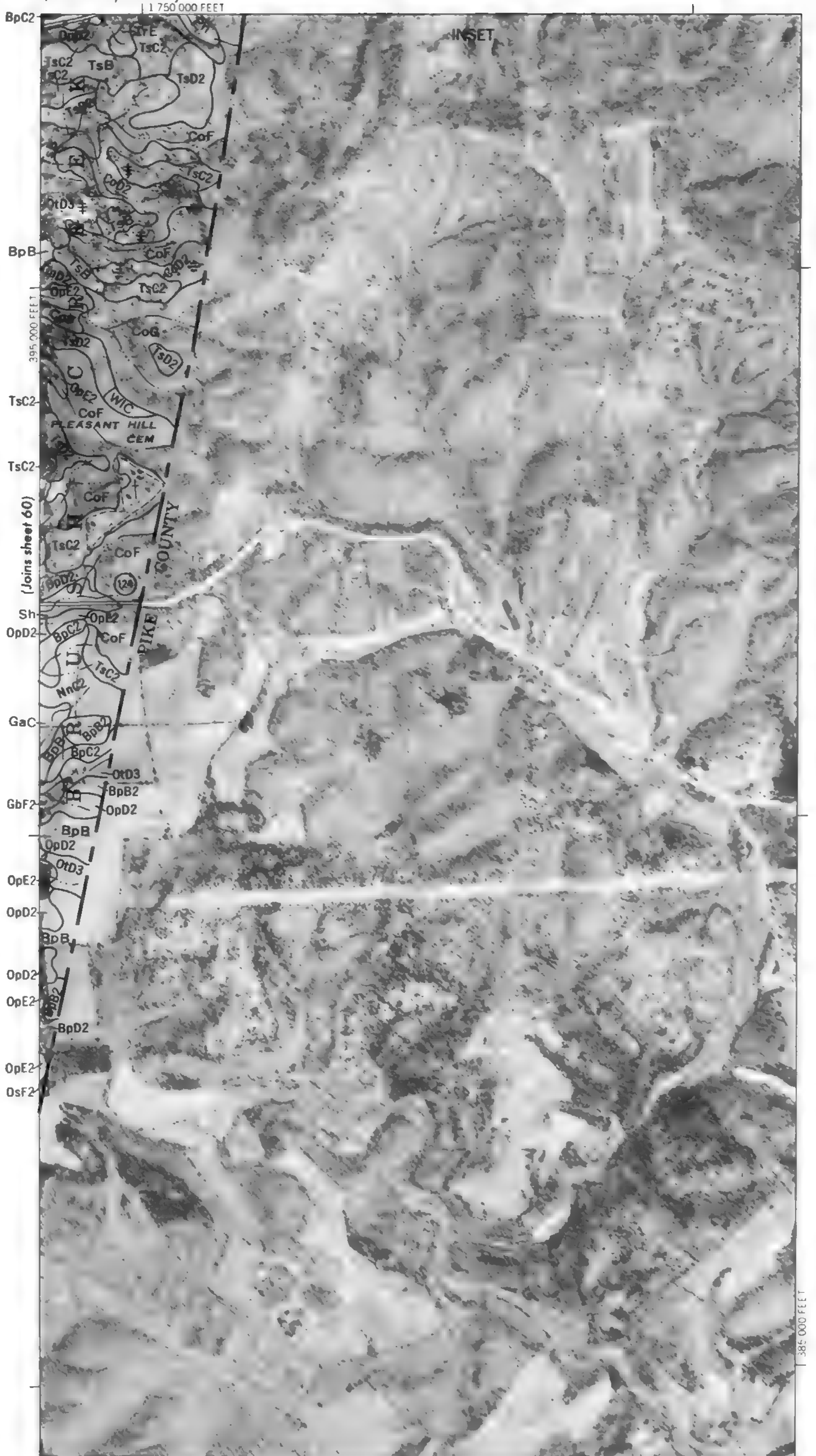
Photobase from 1972 aerial photography. Positions of 5,000 foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

HIGHLAND COUNTY, OHIO NO 23

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.



N

1 Mile

5000 Feet

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

Scale 1:15840

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center

HIGHLAND COUNTY, OHIO NO 25

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone

(Joins sheet 24)

(Joins sheet 17)

(Joins sheet 26)

(Joins sheet 33)

1 635 000 FEET

1 650 000 FEET

440 000 FEET

25

N

1 Mile

5000 Feet

Scale 1:15840

HIGHLAND COUNTY, OHIO — SHEET NUMBER 26

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center

HIGHLAND COUNTY OHIO NO. 26

HIGHLAND COUNTY, OHIO — SHEET NUMBER 27

HIGHLAND COUNTY, OHIO NO 27

This map is one of a set compiled in 19[illegible]'4 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil and the Ohio Agricultural Research and Development Center.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

HIGHLAND COUNTY, OHIO — SHEET NUMBER 29

29

N

1 715 000 FEET

450 000 FEET

(Joins sheet 21)

(Joins sheet 28)

(Joins sheet 30)

(Joins sheet 37)

1 730 000 FEET

440 000 FEET

1 Mile

5 000 Feet

Scale 1:15840

Boston

Rocky Fork Lake

HIGHLAND COUNTY, OHIO NO. 29

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the [illegible] Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

HIGHLAND COUNTY, OHIO — SHEET NUMBER 30

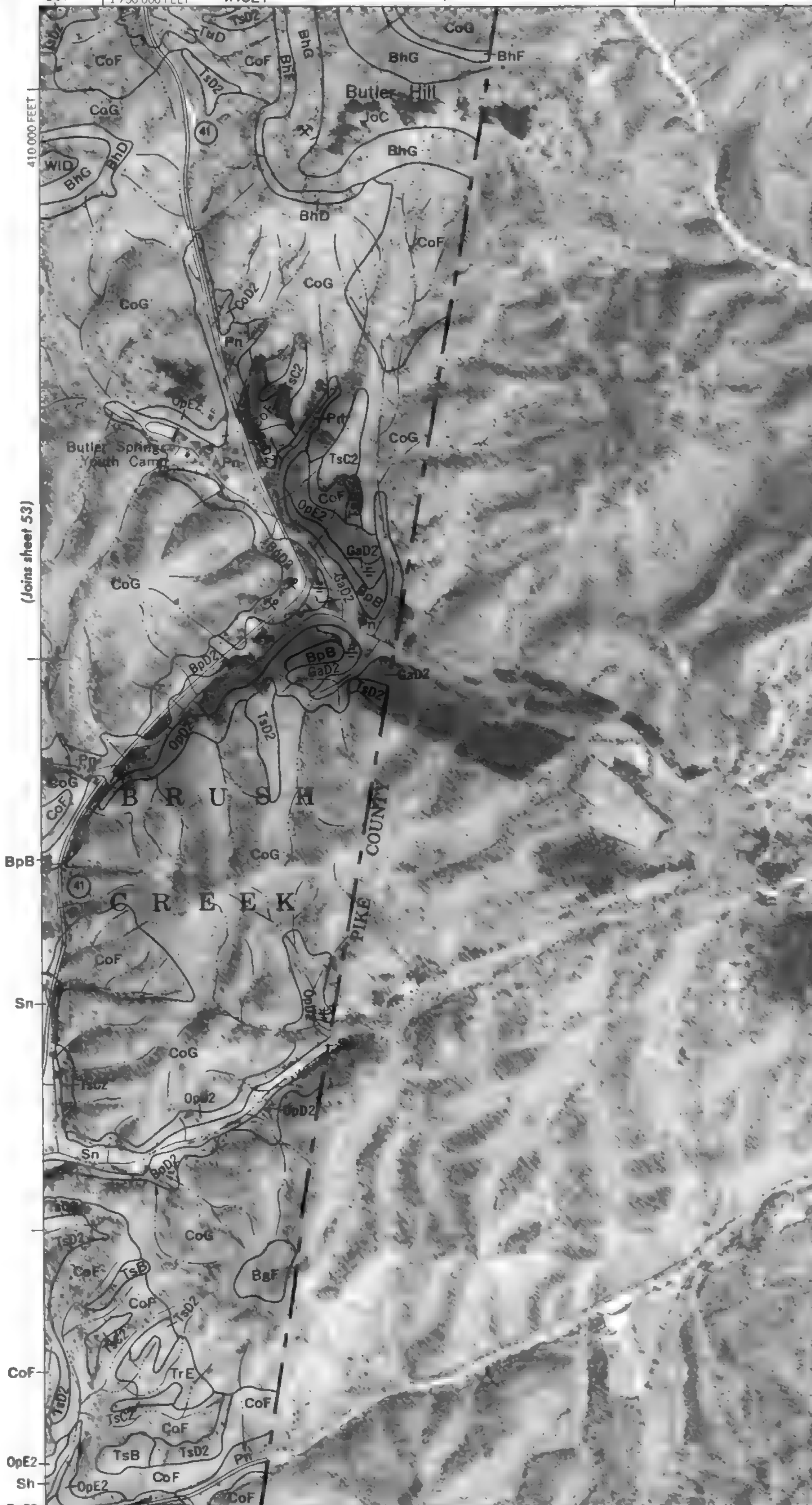
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

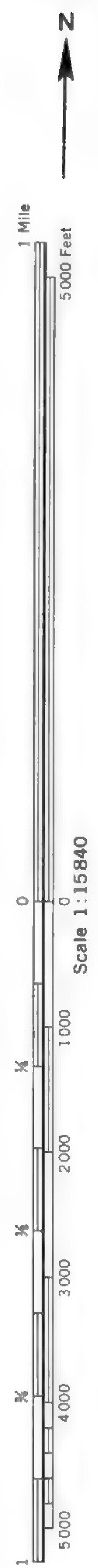
This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center

HIGHLAND COUNTY, OHIO NO. 31

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.





HIGHLAND COUNTY, OHIO — SHEET NUMBER 32

32

N

1 Mile

5000 Feet

Scale 1:15840

(Joins sheet 24)

1 630 000 FEET

440 000 FEET

(Joins sheet 33)

(Joins sheet 40)

1 615 000 FEET

BROWN COUNTY

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soils, and the Ohio Agricultural Research and Development Center

HIGHLAND COUNTY, OHIO NO 32

HIGHLAND COUNTY, OHIO NO. 33

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

HIGHLAND COUNTY, OHIO — SHEET NUMBER 34

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.
This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

(35)

HIGHLAND COUNTY, OHIO NO. 35

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

(Joins sheet 27)

(Joins sheet 43)

N

Scale 1:15 840

1 Mile — 5000 Feet

0 — 1000 — 2000 — 3000 — 4000 — 5000

0 — ¼ — ½ — ¾ — 1

HIGHLAND COUNTY, OHIO — SHEET NUMBER 36

36

N

(Joins sheet 28)

(Joins sheet 35)

(Joins sheet 37)

(Joins sheet 44)

1 705 000 FEET

1 695 000 FEET

430 000 FEET

1 Mile

5000 Feet

Scale 1:15840

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

ROCKY FORK LAKE

ROCKY FORK

MARSHALL

WASHINGTON

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center

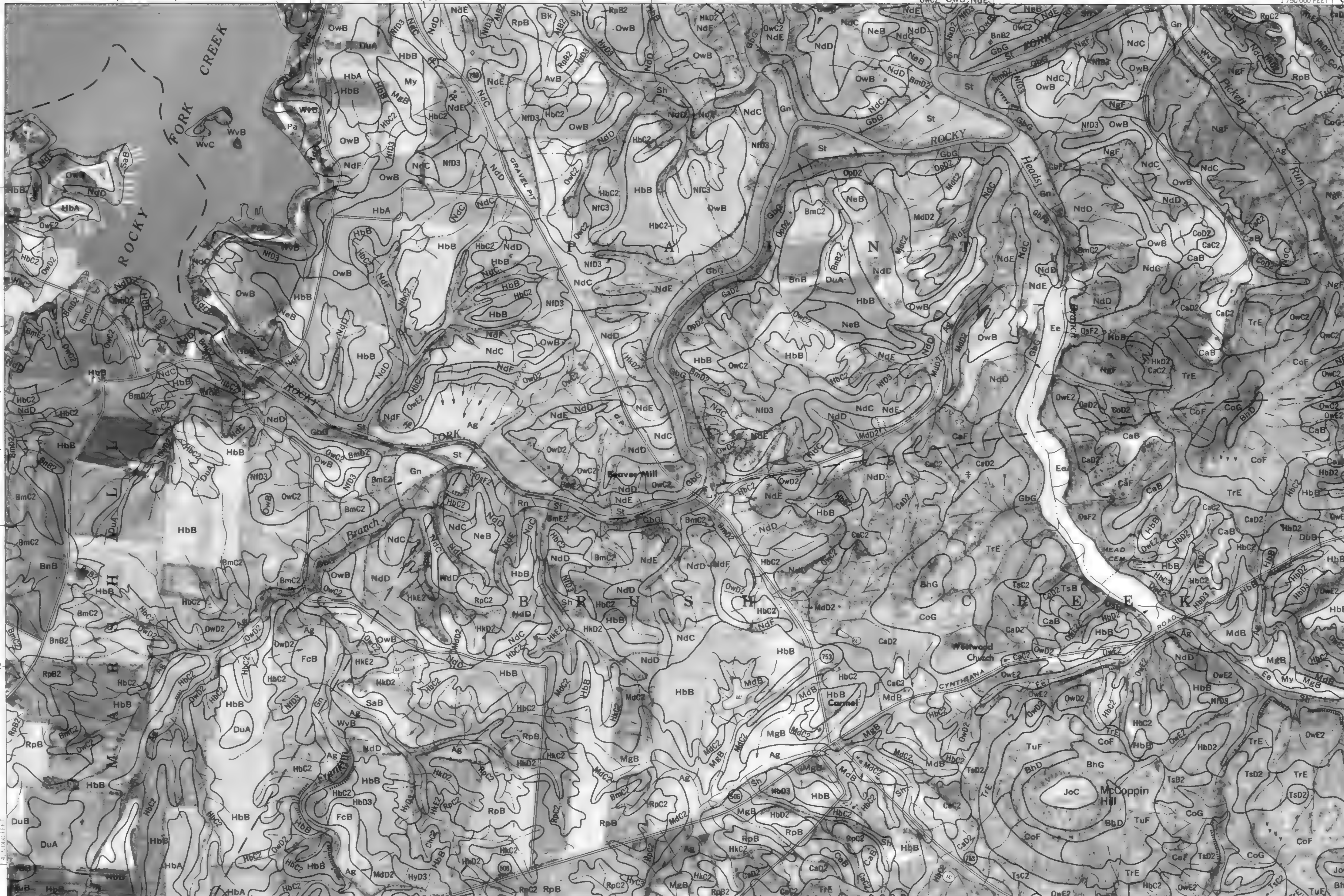
HIGHLAND COUNTY, OHIO NO. 36

HIGHLAND COUNTY, OHIO NO. 37

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

HIGHLAND COUNTY, OHIO — SHEET NUMBER 38

(Joins sheet 30)



(Joins sheet 37)

(Joins sheet 39)

(Joins sheet 46)

N

Scale 1:15 840

1 Mile

5 000 Feet

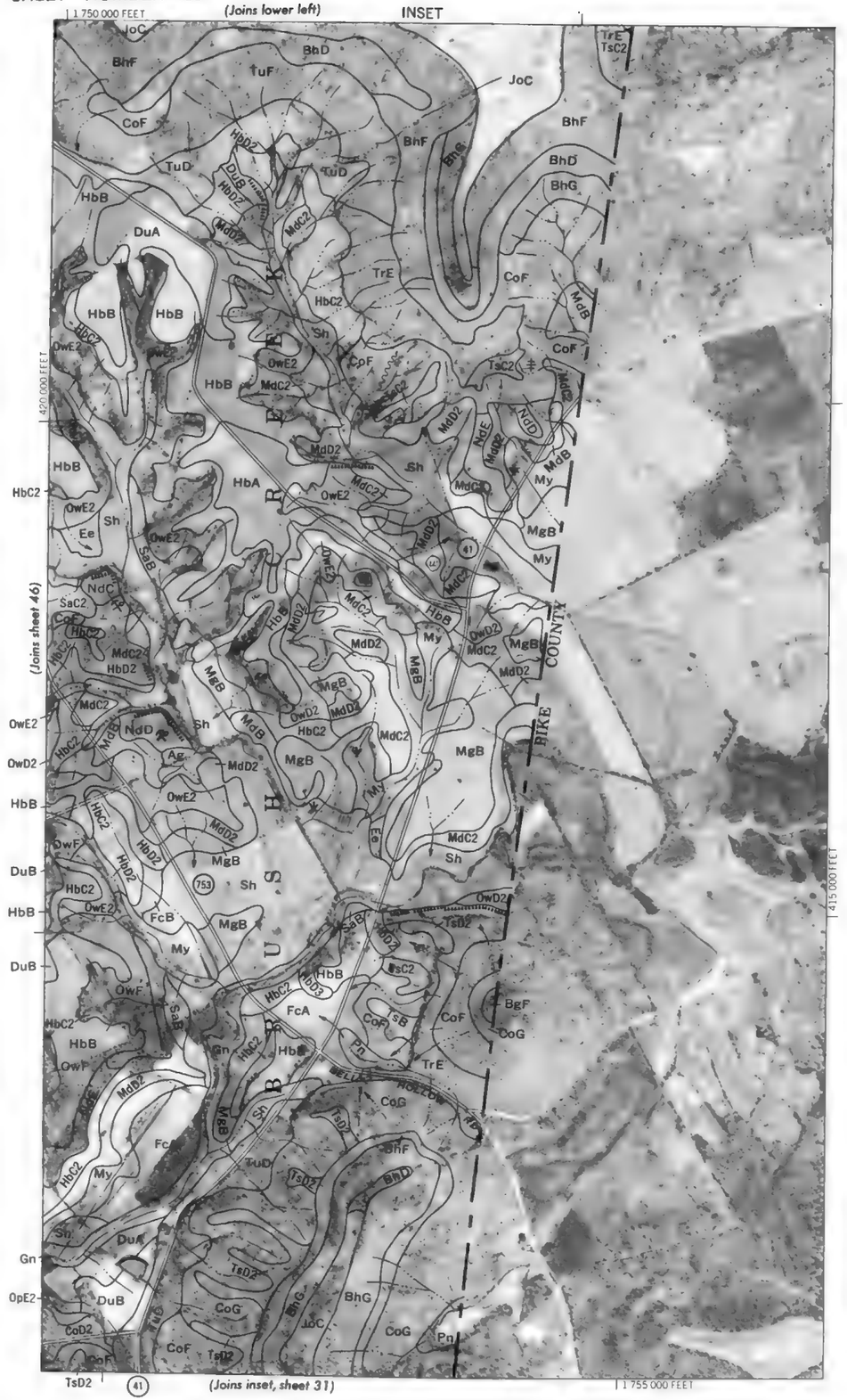
0 1000 2000 3000 4000 5000

Photobase from 1972 aerial photography. Positions of 5,000 foot grid ticks are approximate and based on the Ohio coordinate system, south zone

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center

HIGHLAND COUNTY, OHIO NO. 39

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.



39

N

1 Mile
5,000 Feet

Scale 1:15840

HIGHLAND COUNTY, OHIO — SHEET NUMBER 40

40

N

1 Mile 5000 Feet

Scale 1:15840

(Joins sheet 32)

(Joins sheet 41)

(Joins sheet 47)

1 630 000 FEET

1 625 000 FEET

BROWN COUNTY

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center

HIGHLAND COUNTY, OHIO NO. 40

HIGHLAND COUNTY, OHIO — SHEET NUMBER 41

41

HIGHLAND COUNTY, OHIO NO. 41

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

(Joins sheet 33)

(Joins sheet 40)

(Joins sheet 42)

(Joins sheet 48)

1 635 000 FEET

1 650 000 FEET

1 425 000 FEET

4 500 000 FEET

N

1 Mile

5 000 Feet

Scale 1:15840

Danville

Burt Corners

TOWNSHIP CEM.

ABERNATHY ROAD

C.F.L.

SALEM

HIGHLAND

HIGHLAND COUNTY, OHIO — SHEET NUMBER 42

(42)

N

(Joins sheet 34)

(Joins sheet 41)

(Joins sheet 43)

(Joins sheet 49)

1 Mile

5 000 Feet

Scale 1:15 840

1 670 000 FEET

475 000 FEET

1 655 000 FEET

415 000 FEET

HIGHLAND COUNTY, OHIO NO 42

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

HIGHLAND COUNTY, OHIO — SHEET NUMBER 43

HIGHLAND COUNTY, OHIO NO. 43

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

(Joins sheet 42)

(Joins sheet 35)

(Joins sheet 44)

(Joins sheet 50)

1 675 000 FEET

1 690 000 FEET

1 425 000 FEET

415 000 FEET

Scale 1:15840

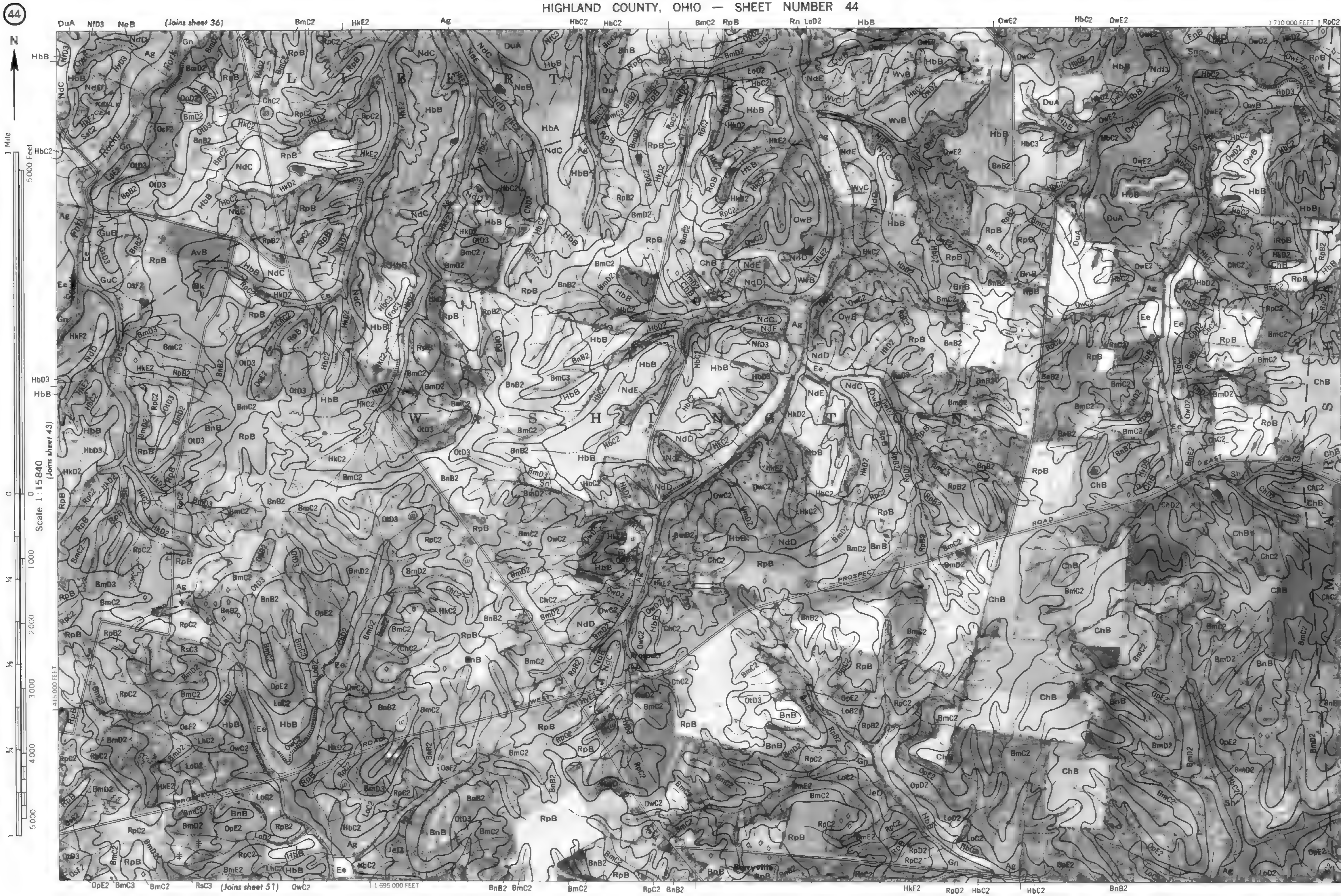
1 Mile

5 000 Feet

N

Mt Washington Church

HIGHLAND COUNTY, OHIO — SHEET NUMBER 44



Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.
This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center

HIGHLAND COUNTY, OHIO NO 44

HIGHLAND COUNTY, OHIO — SHEET NUMBER 45

45

N

(Joins sheet 37)

(Joins sheet 44)

(Joins sheet 46)

(Joins sheet 52)

1 715 000 FEET

425 000 FEET

1 725 000 FEET

415 000 FEET

MARSHALL

BRUSH CREEK

1 Mile

5000 Feet

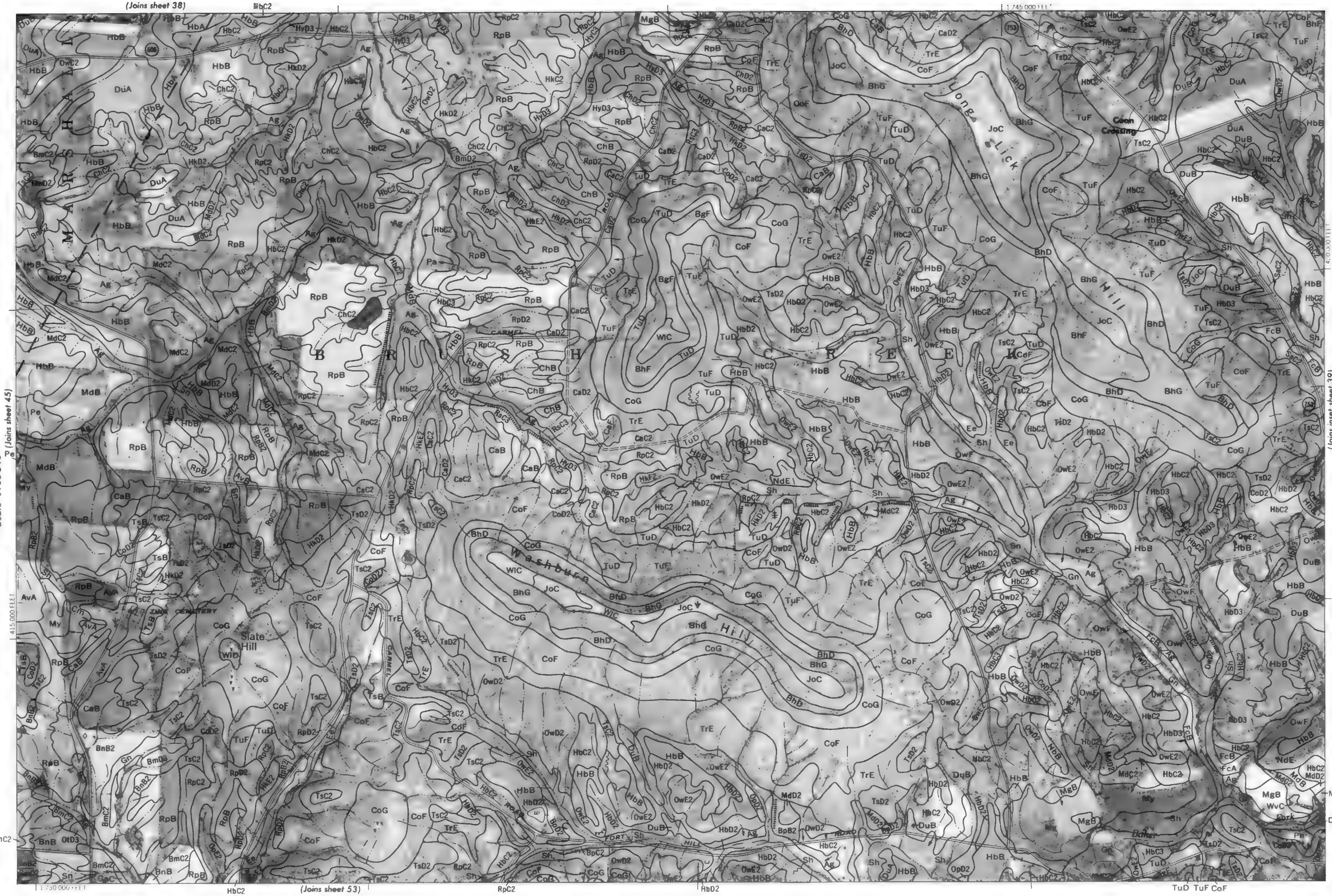
Scale 1:15840

HIGHLAND COUNTY, OHIO NO. 45

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

HIGHLAND COUNTY, OHIO — SHEET NUMBER 46



Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

This map is one of a set compiled in 1974 as part of a soil survey, by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

HIGHLAND COUNTY OHIO NO. 46

HIGHLAND COUNTY, OHIO — SHEET NUMBER 47

HIGHLAND COUNTY, OHIO NO. 47

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

1 615 000 FEET

410 000 FEET

BROWN COUNTY

(Joins sheet 40)

(Joins sheet 48)

(Joins sheet 54)

1 130 000 FEET

405 000 FEET

47

N

1 Mile

5000 Feet

Scale 1:15840

HIGHLAND COUNTY, OHIO — SHEET NUMBER 48

48

N

1 Mile

5 000 Feet

Scale 1:15 840

(Joins sheet 41)

(Joins sheet 47)

(Joins sheet 55)

(Joins sheet 49)

1 650 000 FEET

1 635 000 FEET

4 10 000 FEET

SALEM

HIGHLAND

CLAY

WHITE OAK

Hollowtown

HOLLOWTOWN ROAD

MARKET

NEW

WEST

SOUTH

WESTERN ROAD

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone

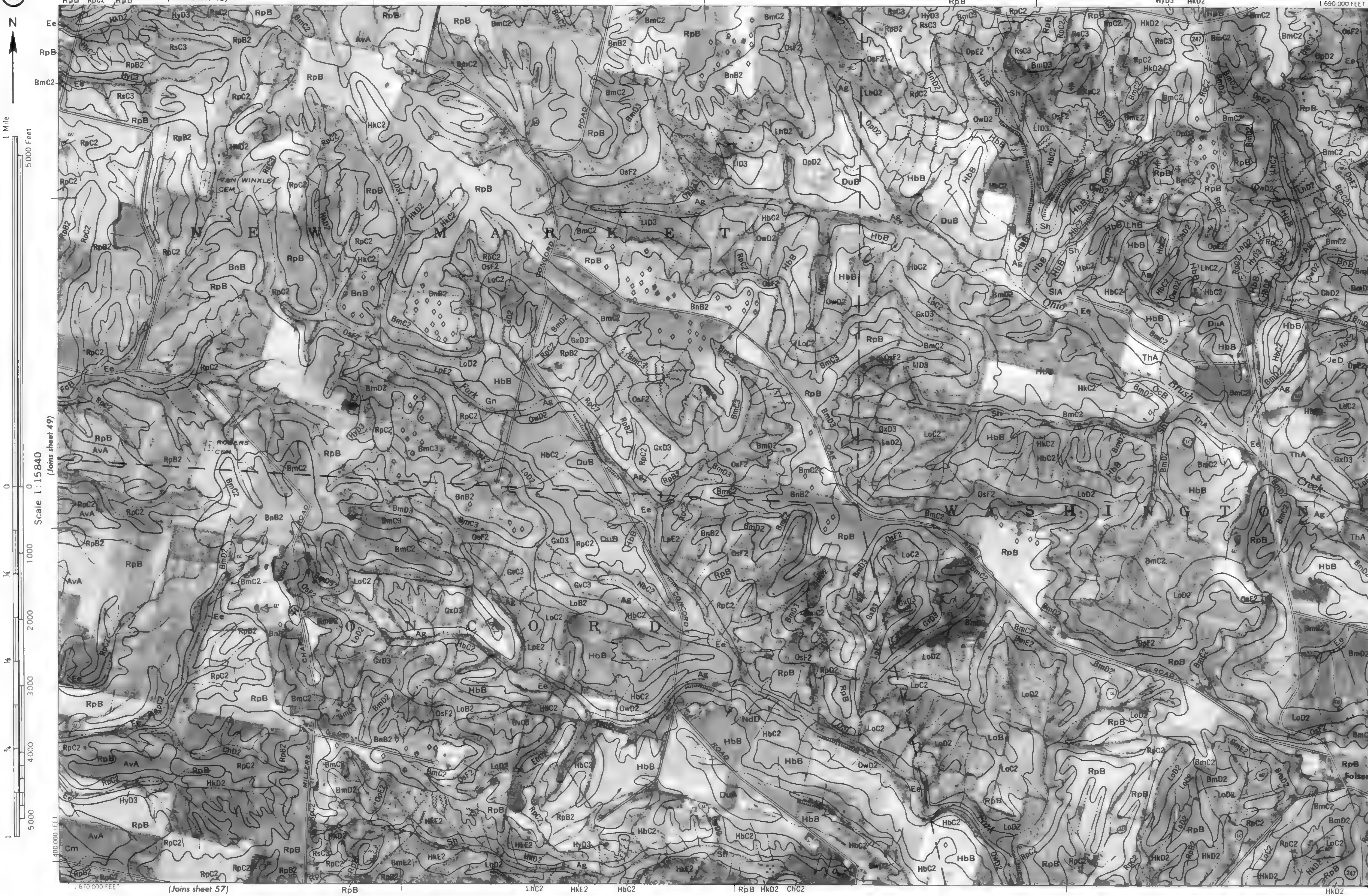
This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

HIGHLAND COUNTY, OHIO NO. 48

HIGHLAND COUNTY, OHIO NO. 49

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone

HIGHLAND COUNTY, OHIO — SHEET NUMBER 50



Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

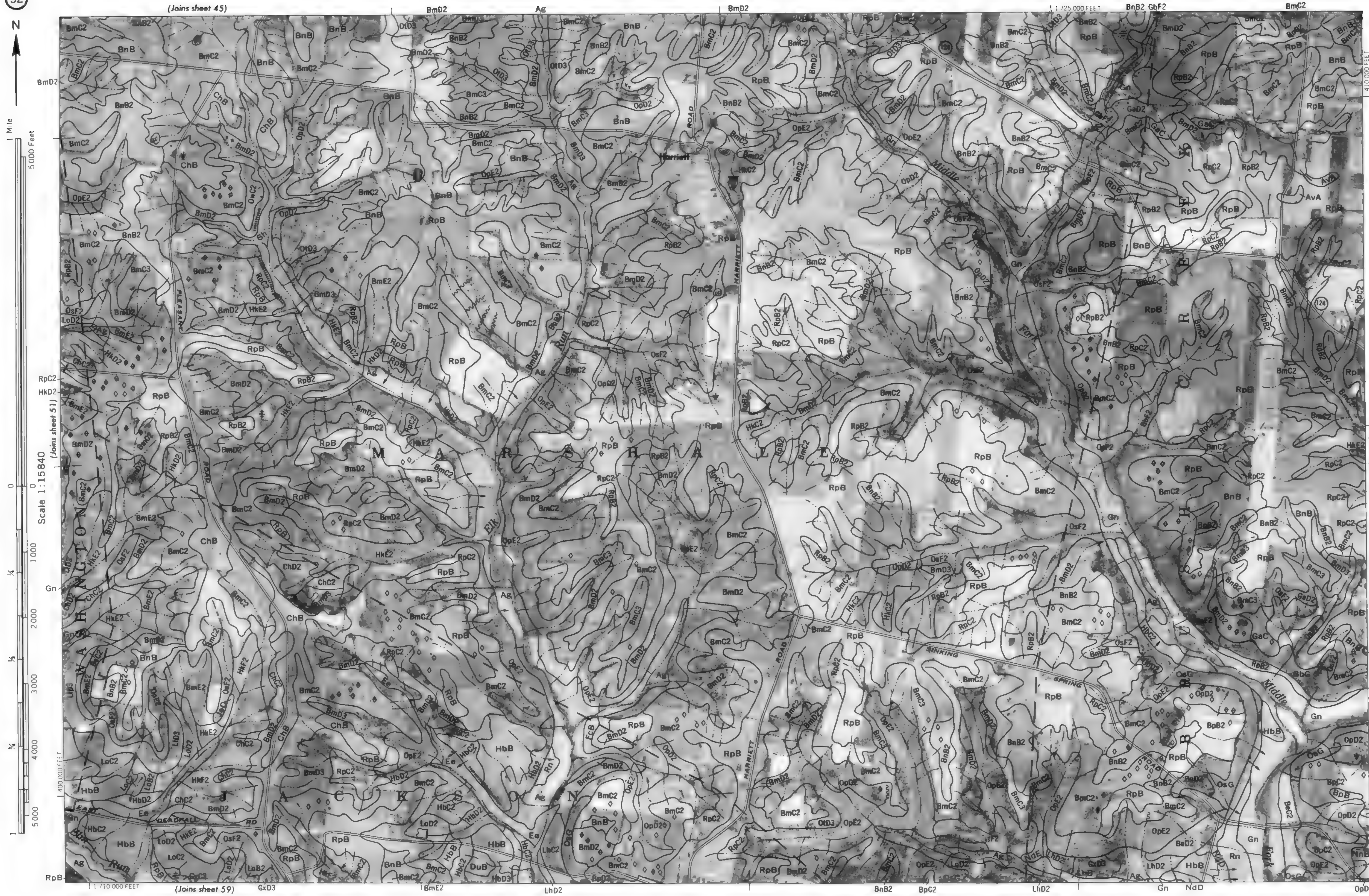
This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

HIGHLAND COUNTY, OHIO NO 51

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone

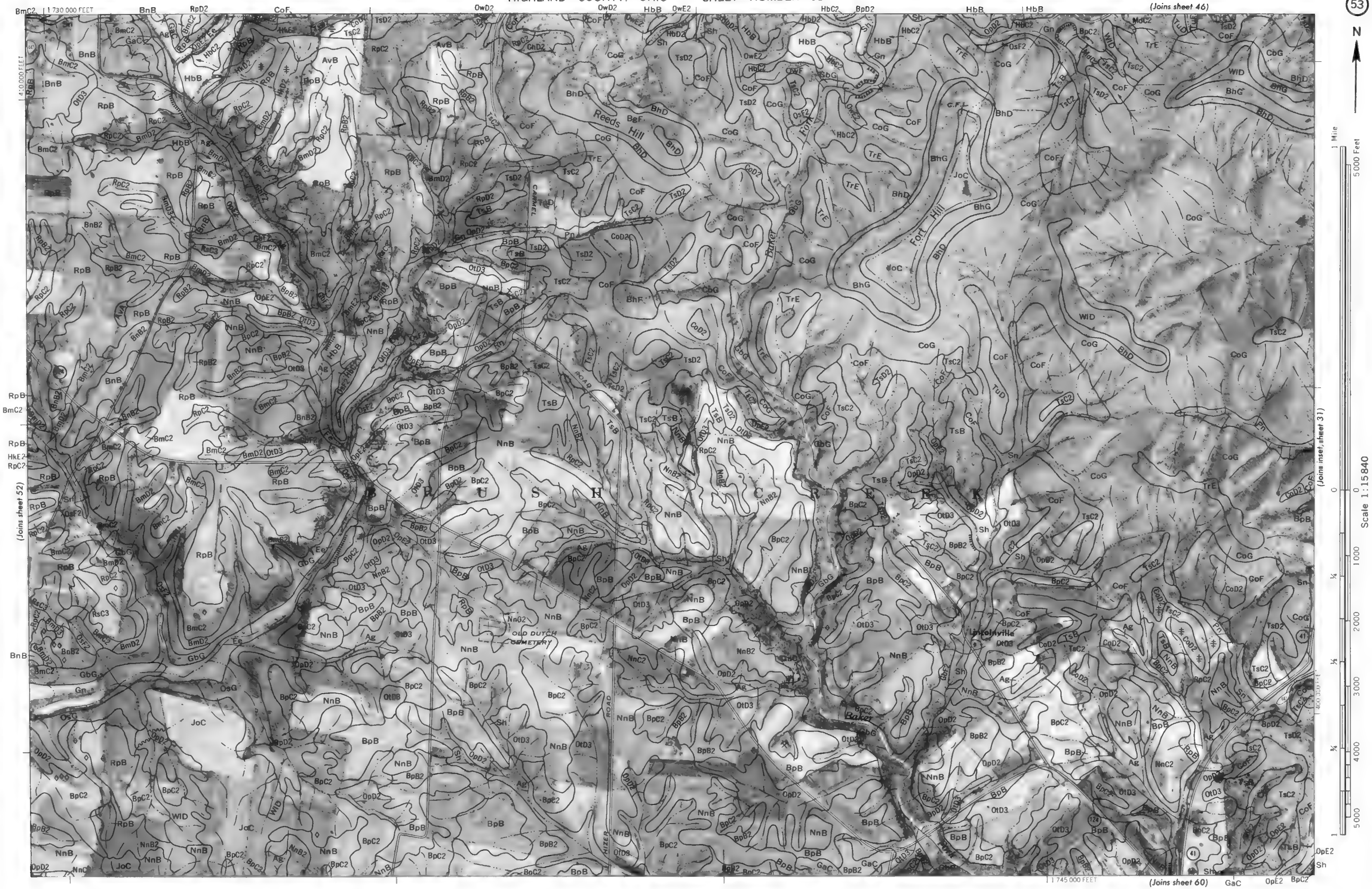
(Joins sheet 50)
(Joins sheet 44)
(Joins sheet 52)
(Joins sheet 58)

HIGHLAND COUNTY, OHIO — SHEET NUMBER 52



Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center



This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

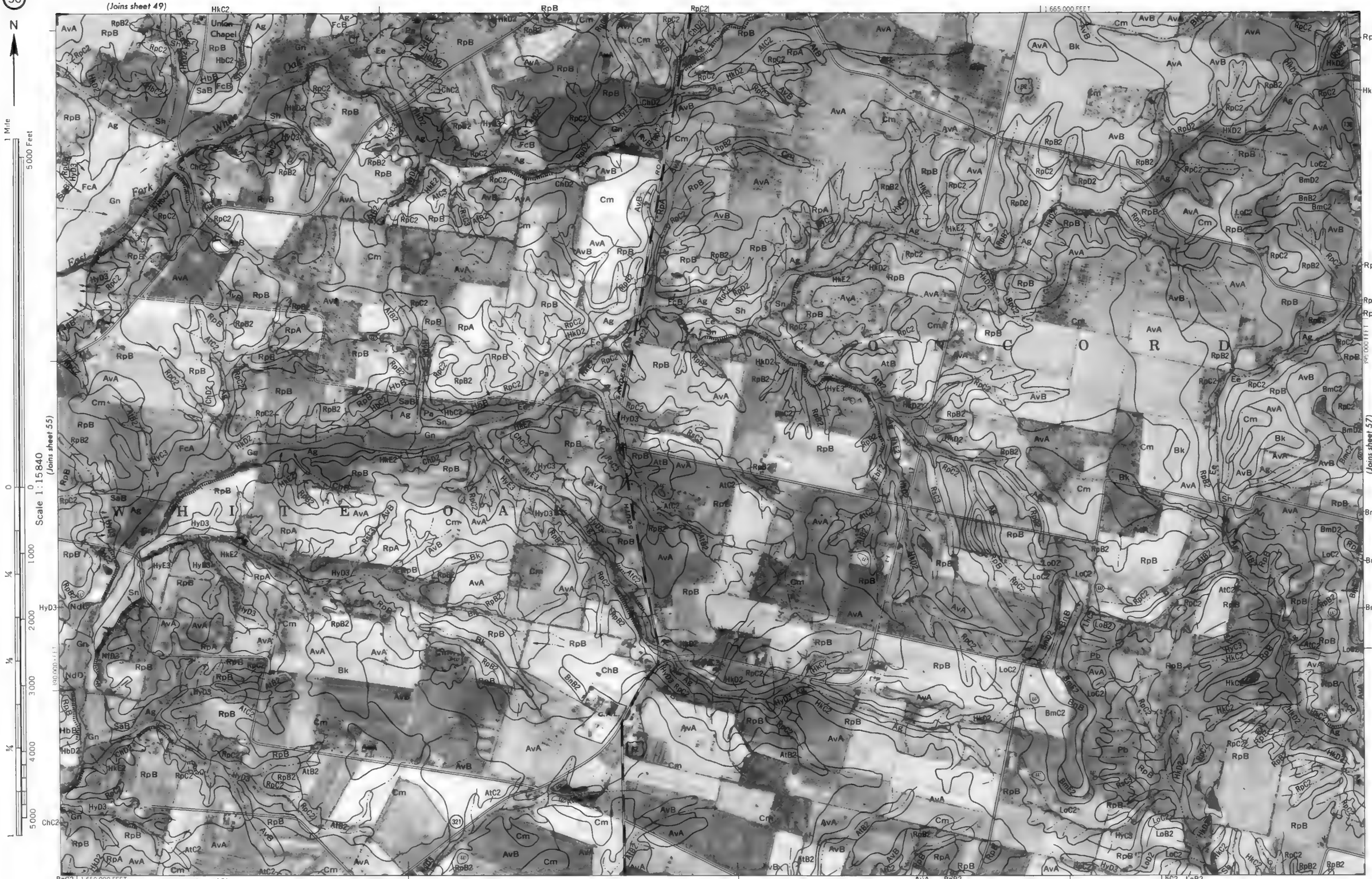
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center

HIGHLAND COUNTY, OHIO NO. 55
This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

(Joins sheet 49)



(Joins sheet 55)
(Joins sheet 57)
(Joins sheet 63)

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone

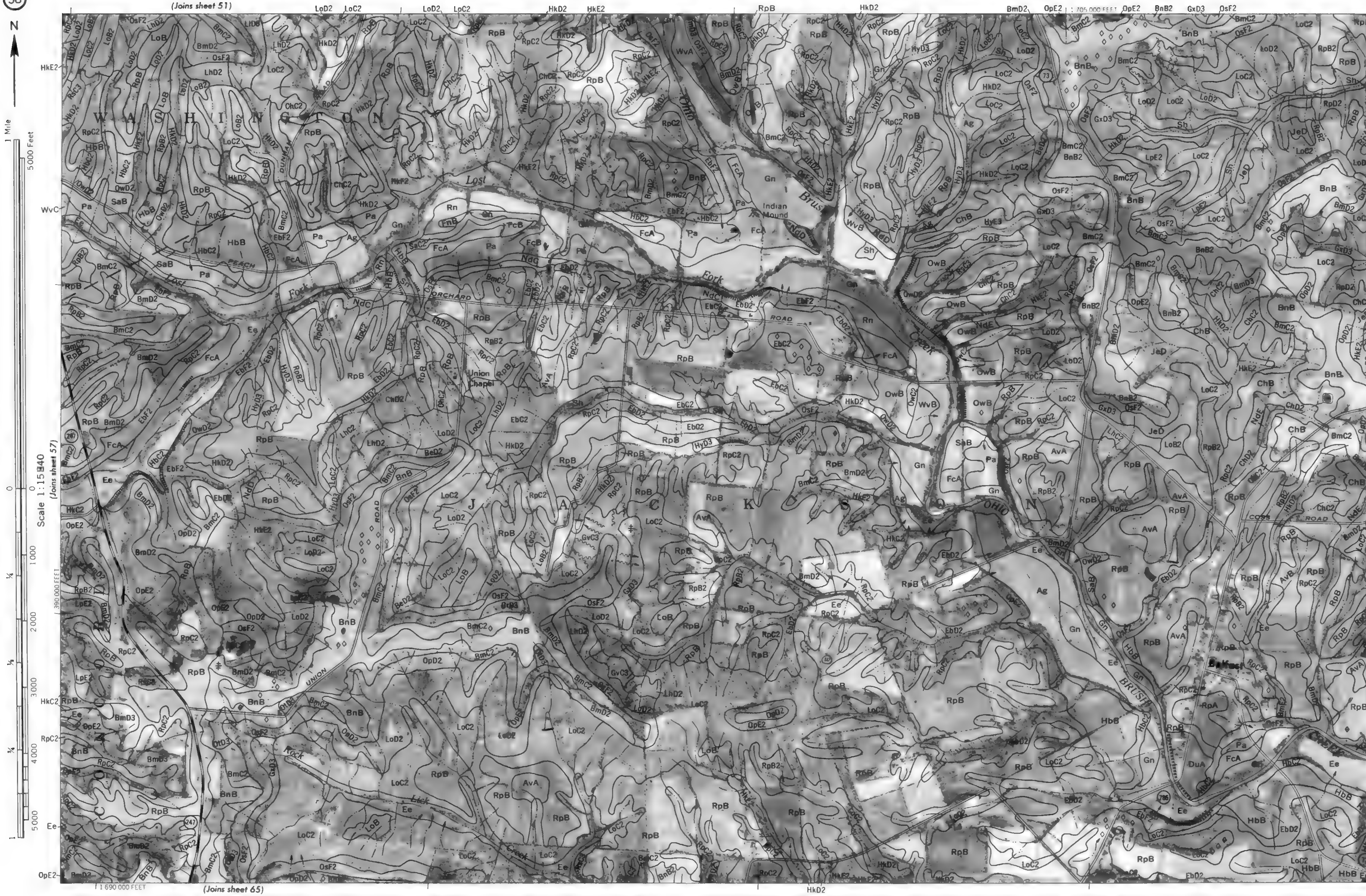
This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center

HIGHLAND COUNTY, OHIO NO. 56

HIGHLAND COUNTY, OHIO NO. 57

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

HIGHLAND COUNTY, OHIO — SHEET NUMBER 58



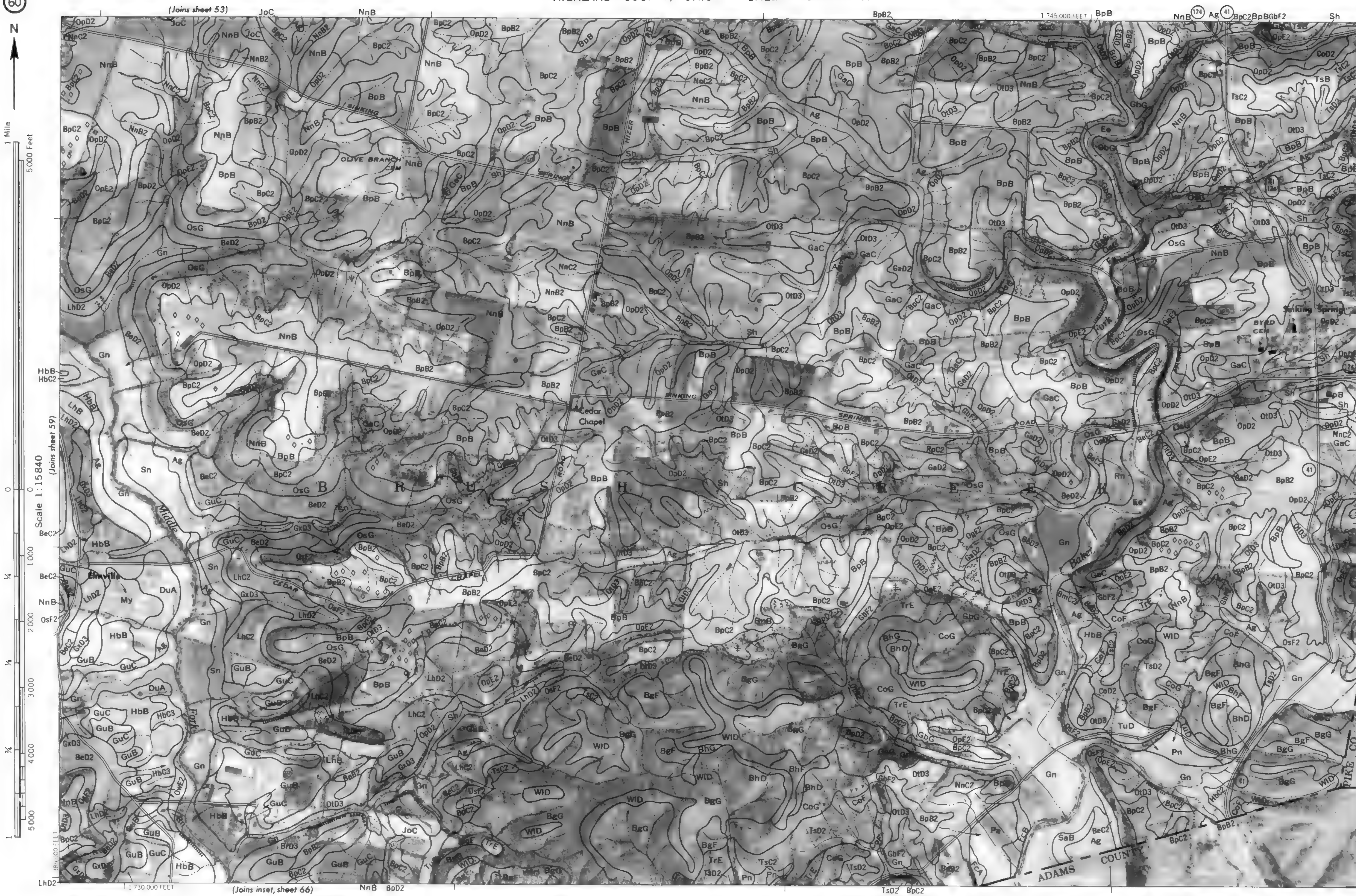
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.
This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

59

HIGHLAND COUNTY, OHIO NO. 59

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

HIGHLAND COUNTY, OHIO — SHEET NUMBER 60



Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.
This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

HIGHLAND COUNTY, OHIO NO. 61

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:15840

N

61

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.
This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center

HIGHLAND COUNTY, OHIO NO. 63

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

HIGHLAND COUNTY, OHIO — SHEET NUMBER 63

1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:15840

N

63

HIGHLAND COUNTY, OHIO — SHEET NUMBER 64

64

N

1 Mile

5000 Feet

Scale 1:15840

1 685 000 FEET

385 000 FEET

375 000 FEET

1 670 000 FEET

(Joins sheet 57)

(Joins sheet 63)

(Joins sheet 65)

ADAMS COUNTY

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

HIGHLAND COUNTY, OHIO NO. 64

HIGHLAND COUNTY, OHIO — SHEET NUMBER 65

HIGHLAND COUNTY, OHIO NO. 65

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

1 690 000 FEET

385 000 FEET

(Joins sheet 58)

(Joins sheet 64)

(Joins sheet 66)

Fairfax

ADAMS COUNTY

375 000 FEET

1 705 000 FEET

65

N

1 Mile

5000 Feet

Scale 1:15840

HIGHLAND COUNTY, OHIO — SHEET NUMBER 66

66

N

1 Mile

5000 Feet

Scale 1:15840

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

(Joins sheet 59)

(Joins sheet 65)

(Joins sheet 60)

(Joins upper right)

(Joins inset)

1 710 000 FEET

1 725 000 FEET

1 730 000 FEET

1 745 000 FEET

379 000 FEET

381 000 FEET

384 000 FEET

3000 AND 5000-FOOT GRID TICKS

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Ohio coordinate system, south zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

HIGHLAND COUNTY, OHIO NO. 66